International Conference on Oil and Gas Security

31 May – 1 June 2002, New Delhi, India

Sponsored by

Oil and Natural Gas Corporation Limited

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International Conference on "Oil and Gas Security- Measures and Response Mechanisms", May 31-June 1, 2002, at Gulmohar Hall, India Habitat Centre, Lodhi Road, New Delhi.

Programme

Friday, 31 May 2002

9.30–10.00 a.m.	**REGISTRATION**
10.00–10.45 a.m.	**INAUGURAL SESSION**
10.00–10.05 a.m.	*Welcome address* Dr R K Pachauri, Director-General, TERI
10.05–10.45 a.m.	*Inaugural address* ▪ Mr Ram Naik, Hon'ble Minister of Petroleum and Natural Gas, Government of India *Vote of thanks* Mr Nirmal Singh (IAS), Senior Fellow, TERI
10.45–11.10 a.m.	TEA
11.10–11.45 a.m.	**SESSION I: ENERGY SECURITY IN INDIA** Review of policy framework for overall energy security in India with special emphasis on oil security *Chairperson* Mr Prabir Sengupta, former Secretary, Ministry of Commerce and Industry, Government of India *Speaker* Dr R K Pachauri, Director-General, TERI
11.45–12.45p.m.	**SESSION II: OIL AND GAS SECURITY – INDIAN EXPERIENCE** Analysis of the existing policy framework regarding crude oil procurement and its supply sources in India will be presented. Experts will also present views on the proposed changes in the policy framework that need to be evolved to ensure oil and gas security in a deregulated market in India.

Chairperson
Mr M S Ramachandran, Chairman, Indian Oil Corporation Ltd.

Speakers
- Mr Nigel Shaw, Chief Executive Officer, British Gas India
- Mr Rajendra Prashad, Senior Manager, Engineers India Ltd.

12.45–1.45 p.m. LUNCH

1.45–3.00 p.m. **SESSION III: OIL AND GAS SECURITY – INTERNATIONAL EXPERIENCE**
Presentations will be made on the international experience on oil and gas security measures.

Chairperson
Mr Subir Raha, Chairman and Managing Director, Oil and Natural Gas Corporation

Speakers
- Dr Sanjiv Misra, Joint Secretary, Government of India;
- Mr S K Sharma, Executive Director (International Trade and Shipping), Bharat Petroleum Corporation Ltd.
- Mr I L Budhiraja, President, Oil and Gas, Reliance Industries Ltd.

3.00–3.30 p.m. TEA

3.30–5.15 p.m. **SESSION IV: WORKING GROUPS**
Two working groups will discuss policies, issues, concerns, and strategies with respect to oil and gas security in India and come up with the proposed changes that will be needed in a deregulated scenario. The coordinators will present the conclusions of their respective groups in Session VI.
(WORKING GROUPS WILL BE HELD AT TERI, IHC)

Saturday, 1 June 2002

9.30–10.50 a.m. **SESSION V: RESPONSE MECHANISMS**
This session will provide an assessment of the response mechanisms that can achieve oil and gas security in a crisis situation in India. This includes:

1. Demand restraint measures
2. Cooperation among neighbouring countries
3. Government v/s market-oriented response.

Chairperson
Mr Proshanto Banerjee, Chairman and Managing Director, Gas Authority of India Ltd.

Speakers
- Mr Rajeev Khanna, Business Development Manager, Gas Authority of India Ltd.
- Dr G S K Masud, Vice-President, Indian Oiltanking Ltd.

10.50–11.15 a.m. TEA

11.15–12.00 noon **SESSION VI: PRESENTATIONS OF THE WORKING GROUPS ON 'POLICY FRAMEWORK ON OIL AND GAS SECURITY IN A DEREGULATED SCENARIO IN INDIA'**
(2 presentations: one by each Working Group from Session IV)

12.00 noon–1.00 p.m. **SESSION VII: PANEL DISCUSSION**
This session will have policy-makers from the government and eminent experts from the oil sector.

Chairperson
Mr Prabir Sengupta, former Secretary, Ministry of Commerce and Industry, Government of India

Panellists
- Mr S K Sharma, Executive Director (International Trade & Shipping), BPCL
- Mr J S Oberoi, Convenor, Energy Think Tank, Surya Foundation

VOTE OF THANKS
Ms Preety Bhandari, Director, Policy Analysis Division, TERI

1.00–2.00 p.m. LUNCH

Oil security: issues, measures, and response mechanisms

Introduction

Oil security issues emerged in the early seventies with the onset of the Arab oil embargo in 1973 when crude prices jumped from the then prevailing price of $2/bl to more than $10/bl. In all there have been seven major oil supply disruptions till date when world crude supply fell short by more than 2 million barrels per day (Figure 1).

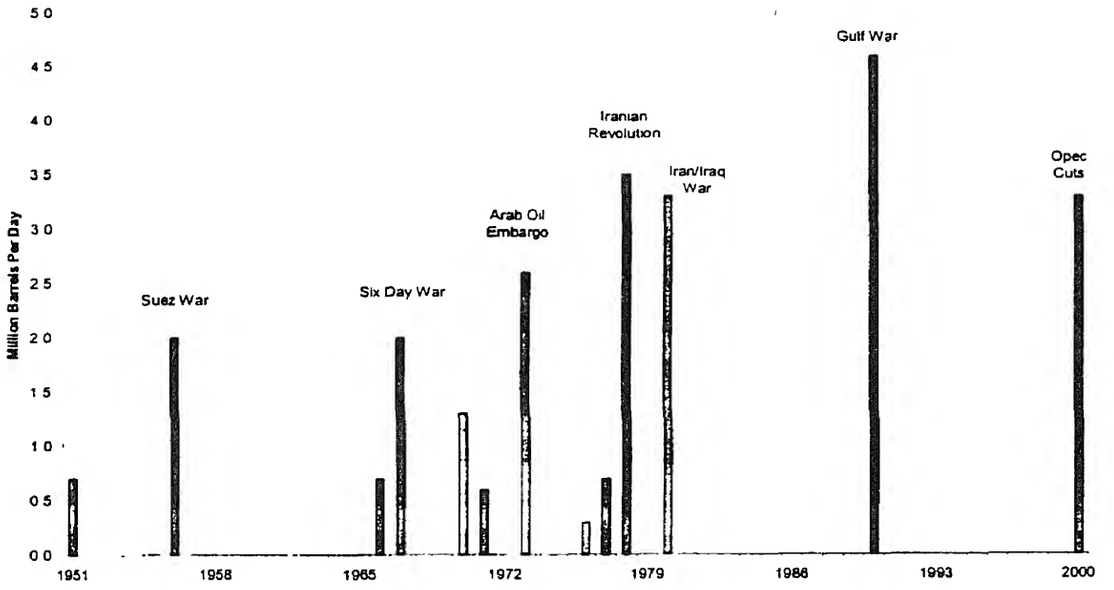

Figure 1 World oil supply disruptions

The implications of these disruptions have been significant, especially for the developing countries. A recent United Nations study has determined that with the upward oil price rally in 2000, oil imports of developing economies were higher by $60 billion in 2000 as compared to 1999, and that the increase was equivalent to 1.3% of the GDP (Gross Domestic Product) of developing economies.

Emergency response policies: international review

The 1973 price shock prompted governments the world over to think on oil security policies. The immediate outcome was the formulation of the IEA (International Energy Agency) to implement the IEP (International Emergency Program). Initiated with 16 OECD (Organisation for Economic Co-operation and Development) countries, the IEA today has 26 members. Under the IEP, member countries have a commitment to hold oil stocks equivalent to 90 days of net oil imports. The IEP defines an integrated set of emergency response measures - stockdraw demand restraint, fuel switching, surge oil production, and sharing of available supplies. The response measures are triggered by disruptions reducing oil supply by 7%. For disruptions below this level, the IEA has a complimentary set of measures known as the CERM (Co-ordinated Emergency Response Measures). These provide a rapid and flexible system of response to actual or imminent supply disruptions.

However, despite the co-ordinated policies, their remains significant policy diversity amongst IEA member countries. A review of emergency response policies in select countries is presented below.

United States

The US is a strong supporter of market forces, even in times of emergency. The US policy believes in utilising markets to allocate scarce oil resources and considers that government response measures should be designed to complement, rather than supplant, market forces. The US policy targets avoidance of disruption - induced economic damage and accordingly believes in the early use of its SPR (Strategic Petroleum Reserves). Under the US legal framework, the US Administration has exclusive authority over the drawdown and distribution of oil from the SPR. The law authorises the US President to use the SPR if he finds that such actions are 'required by a severe energy supply interruption or by obligations of the United States under the IEP'. In 1992, the policy was amended to permit the President to take price increase into account for determining SPR drawdown. Given the US belief in credibility of market forces, the drawdown and release of SPR oil are primarily accomplished by means of a price competitive sale with the awards going to the highest bidders.

Germany

In Germany, with 98% import dependence for oil, security issues have been a high priority for the German government. In contrast to the US policy, Germany places substantial emphasis on energy conservation and efficiency. Principal

tools used to cope with supply disruptions are - stockdraw and demand restraint. The country has a contingent demand restraint programme designed to comply fully with the IEP. The Energy Security Law gives the government the needed legal authority on production, transport, stockholding, trading, and allocation of crude oil and petroleum products in a crisis situation. The actual planning and management in a crisis is organised in co-operation with the industry, reflecting a market-oriented approach. The co-operative structure of the NESO (National Emergency Sharing Organisation) is based on voluntary agreements between parties concerned under the Energy Security Law. Oil stocks are managed and released by EBV (*Erdolbevorratungsverband*). The Oil Stockholding Law stipulates that neither public funds nor direct state guarantees be made available to the EBV. The operating costs of the EBV are met by membership fees wherein all refiners and importers of relevant products are members of the EBV. The fees in turn are reflected in prices passed on to consumers.

United Kingdom

The British government approach tends to encourage and support industry-led arrangements in emergency situations. In a crisis, the government would monitor and consult with the industry about the extent to which market mechanisms have been affected before taking any decision. The preferred response is to arrange for appropriate release of stocks, while demand restraint is also considered important in the longer term. Being a net exporter of natural gas, Britain also has the option to consider fuel switching where applicable. The response framework covers internal exigencies as well, of the sort witnessed in September 2000 in the UK in reaction to high fuel prices. There were widespread protests all over the country along with heavy demand for key transportation fuels, which led to sever shortages. As a fallout, a taskforce was set involving ministries, oil industry, police, trade unions, and transporters, which resulted in a MoU (Memorandum of Understanding). The MoU committed the relevant parties to joint early warning systems and joint crisis management systems. New procedures have four stages for fuel alerts with responsibilities set for both the government and the industry for each stage.

Being a net oil exporter, UK has no obligations to hold stocks under the IEA's IEP. However, it is obliged to hold stocks equivalent to 671/2 days of previous year's consumption under the EU (European Union) Directive governing holding of emergency stocks of oil. Emergency stocks are held by oil companies as part of the normal industry stocks and thus can be distributed through the

existing distribution channels only. Stockholding is financed by the oil industry itself.

The UK places greater emphasis on information availability, industry co-operation and flexibility rather detailed planning to respond to crisis situations.

Lessons for India

As seen from the above, there is considerable diversity in the approach towards handling of crisis situations within the IEA member countries. In devising its own response strategy, India could draw lessons from such different approaches. Issues to be addressed include

- policy focus: stock-draw; demand restraint; fuel switching; surge oil production, etc.;
- emergency organisation: legislation; co-ordinating mechanisms; administrative set up; stock drawdown procedures, etc.;
- strategic reserves: stock structure issues- crude/ products; government/company stocks; etc.; and
- financing options.

Although India is not a member of the IEA, a Declaration of Co-operation was signed between the Government of India and the IEA in 1998. Activities envisaged under this Declaration include exchange of energy information and data; dialogue on energy sector investment; joint seminars, workshops, and conferences; and exchange of expertise. Further interaction with IEA and its member countries can help India formulate a well-defined emergency response policy and organisation.

Fuelling oil security concerns: the Indian case

The share of oil in the country's fuel mix has steadily risen from 25% in 1960s to about 33% in the 1990s. Though the energy elasticity is projected to decline to 0.55 in 2025 from the present 0.70, the share of oil in overall energy availability is projected to increase to 40% over the same period.

Since our domestic production has failed to keep pace with this rapid rate of growth, our import dependence for oil has risen from 44% in 1991 to over 70% in 2001. In the year 2000/01, we imported 74 MMT (million tonnes) of crude oil for a total refinery throughput of 103 million tonnes. Of the total imported crude, 55 MMT was sour and the rest, about 19 MMT, was sweet. What is more important is the fact that 65% of crude out of total sweet crude imports was supplied by only one country, Nigeria. Out of 55 MMT sour crude also, the

majority came from Saudi Arabia, though some private refineries have started to take crude from countries as far as Venezuela.

Future oil demand, which is placed at around 276 MMT in 2025 by the Hydro Carbon Vision 2025 document, will result in substantial increases in the oil import dependence unless we struck a major discovery, the prospects of which do not seem very optimistic at present. The Tenth Plan forecasts the import dependency of 85% by 2006/07 out of which sour crude will be 78% which is likely to be sourced mainly from Middle East since it is the largest producer of sour crude in the world and is economically attractive to India.

However, no other commodity, which is traded on the same scale, is exposed to as much risks of supply as oil. The now regular price shocks, political tensions in the major oil producing region of the world (Middle East), and even variations in weather in one country can disrupt the oil supplies and hence the economy of some other country. It is estimated that the direct cost to the world economy of the Gulf War in 1990 was over $100 billion. Hence the countries, which are heavily dependent on oil imports, need to have some security mechanism in place to ensure the timely availability of oil for their economy.

Specifically, ensuring the security of oil supplies is important due to the following factors.

1. Political environment in producing countries
2. Dependence of oil trade on few specific supply routes
3. Recent trend of cartelisation by OPEC (Organisation of Petroleum Exporting Countries) and other major oil producers.

Each of these is further discussed below.

Political environment in producing countries

Major oil producing countries like Iran, Iraq, Nigeria, Libya, Algeria, Indonesia and the whole of Caspian region have a tumultuous political history. Among these, India is currently sourcing crude from Iran, Iraq, Nigeria, and Indonesia.

Sanctions imposed on Iran under ILSA are undermining Iranian efforts to attract foreign capital and technology for its oil and gas industry. And there are some contentious issues between Iran and the West like Iran's opposition to Middle East peace process and hostile US-Iran relations due to various reasons. Currently, Iran is involved in a dispute with Azerbaijan over Caspian Sea and has taken offence at Azerbaijan moving ahead with exploration of Alov-Sharg-Araz block in the Southern Caspian.

Iraq has been subject to international sanctions since its invasion of Kuwait. And its growing reluctance to yield to UN demands is further causing tensions with the West. Recently, Iraq suspended the oil exports for one month under the oil-for-food programme, in protest against the Israel occupation of Palestine territories, which caused a sharp rise in oil prices.

Nigeria is experiencing an ongoing inter-ethnic tension and an uprising against oil companies by youths protesting the environmental degradation of indigenous homelands and their marginalisation in terms of federal resource allocation. Illegal fuel siphoning as a result of thriving black market for fuel products has increased the number of oil pipelines explosions in recent years. The US has estimated that as much as 300,000 bbl/d of Nigerian crude is illegally bunkered out of the country.

Indonesia has experienced significant economic and political turbulence over the past few years, which has impacted its oil and gas sector. East Timorese independence has called into question the Timor Gap treaty, under which Indonesia and Australia had agreed to split revenues from oil and gas development in the Timor Gap, which is being explored by Pertamina, Phillips Petroleum, BHP, Santos and Shell Australia. Besides East Timor, Indonesia faces separatist movements in resource rich provinces like Aceh, East Kalimantan, Irian Java and Riau. In early July 1999, a mob attacked Arun LNG facility located in Aceh. Operations were resumed only after two years.

Dependence of oil trade on few specific supply routes

The US government has identified seven transit points, choking of any one of which will cause tremendous volatility in oil prices since about 30 million barrels/day of oil passes through these routes.

Bab El-Mandab: This route, connecting Red Sea with Gulf of Aden and the Arabian Sea carries about 3.3 mbbls/d of crude oil to Europe, the US, and Asia. Closure of this would mean that tankers from Persian Gulf would not be able to reach Suez Canal and would be diverted to Cape of Good Hope thereby increasing transit time and cost and effectively tie up the spare tanker capacity.
Straits of Bosporus: Located in Turkey, this 17-mile waterway carries about 1.7 mbbls/d of oil headed for Europe. This is one of the most difficult waterways to navigate. However, exports through these straits have grown since break-up of Soviet Union and there is a growing concern that projected Caspian Sea export volumes exceed the ability of these straits to accommodate the tanker traffic.

Panama Canal/Trans Panama pipeline: This canal, connecting the Pacific Ocean with the Caribbean Sea and the Atlantic Ocean carries about 0.6 mbbls/d of crude oil. Petroleum was the second largest commodity shipped through this canal after grains. If transit through this canal were stopped, the 860,000 bbls/d Trans-Panama pipeline would have to be reopened to carry oil in either direction.

Russian Oil and Gas Export pipelines/ports: These pipelines pass through Russia, Ukraine, Belarus, Hungary, Slovakia, the Czech Republic, and Poland. Russia being a major supplier of crude oil and natural gas to Europe, the main concern is the lack of spare capacity in the export pipelines and ports.

Strait of Hormuz: It is located in Oman/Iran and connects Persian Gulf with the Gulf of Oman and the Arabian Sea. About 15.4 mbbls/d of oil flows through this strait destined for the US, Japan, and Western Europe. It is considered as the world's most important choke point. Closure of this port would require use of longer alternative routes like the 5 mbbls/d capacity Petroline and the Abqaiq-Yanbu natural gas liquids line across Saudi Arabia to Red Sea.

Strait of Malacca: It is located in Malaysia/Singapore and connects Indian Ocean with the South China Sea and the Pacific Ocean. It carries about 9.5 mbbls/d of crude oil destined for Japan, South Korea, China, and other Pacific Rim countries. If the strait were closed, nearly half of the world's tanker fleet would be required to sail farther, creating a need for extra tanker capacity and would raise the freight rates worldwide.

Suez canal/Sumed Pipeline: Located in Egypt, it connects Red Sea and the Gulf of Suez with the Mediterranean Sea. It transports about 3.1 mbbls/d of crude oil destined for Europe and the USA. Closure of Suez Canal and/or Sumed pipeline would divert tankers around the Southern tip of Africa adding greatly to the transit time and increasing the freight rates.

OPEC influence on oil prices

OPEC controls about 65% of world proven oil reserves. Recently, it has formed an effective cartel for influencing oil prices. It has already made public its desire to keep the prices in the band of $22 - $28 per barrel and with many OPEC countries balancing their budget within this band, it will be in the interest of OPEC to keep the price high by cutting the production.

For countries like India, which are heavily dependent on oil imports for meeting their requirement, these factors are likely to be major cause of concern. And in view of all these factors, it is important that India should have a mechanism in place to ensure the security of oil supplies.

Deregulation of the Indian oil industry

Domestic factors too are fuelling oil security concerns, in particular, deregulation of the oil industry. Given the wide-spread usage of petroleum products in the economy, their availability at affordable prices is a critical issue. With the dismantling of the APM (Administered Pricing Mechanism) for the industry, availability of 'sensitive' products (transportation fuels – motor spirit and high speed diesel; and domestic fuels – superior kerosene oil and liquefied petroleum gas) too is governed by market forces. While the government has directed PSUs (Public Sector Undertakings) to hold current prices for a period of three months immediately following deregulation, thereafter, companies would be free to fix market determined prices. In holding price lines, oil marketing companies are already reportedly running up substantial losses as international product prices are bullish. In the absence of the government directive, sensitive fuels would already have been dearer.

The implications of this are likely to be more profound in a crisis situation. Supply disruptions inevitably lead to spiralling oil prices. In the absence of a structured policy, supply disruptions may occur resulting in spiralling prices, thus, hurting vulnerable sections of society.

Oil security: temporal dimensions

Long-term oil security

Ensuring long-term security of supplies essentially means reducing the dependence for oil imports and certainly reducing the dependence on any particular source. The non-diversification of sources of supplies has the potential to disrupt the economy because of a singular disturbance in that region which would then be exported to our country. In order to shield the economy from such external disturbances, it is essential to have a diversified portfolio for the oil supplies.

The following measures can be taken to ensure long-term oil supply security.

i. Identification of alternative sources of imports
ii. Encouraging equity oil
iii. Giving equity in refining and marketing to Middle East and other important producers
iv. Restricting oil imports by increasing domestic production.

Option I - Identification of alternative sources of supply in order to diversify the import portfolio

Currently, Middle East enjoys the highest share in the total crude oil imports by India. With 65% of world's proven reserves, Middle East is unlikely to be dethroned from its ace position in India's crude supplies portfolio. However, there are some other countries/areas that could contribute to India's crude imports.

- Central and South America
- Western Africa
- Caspian Sea
- North Sea

Issues in diversifying crude supply sources

Availability of supplies

The first and foremost issue is the analysis of the potential reserves that these countries hold and their export potential. Although none of these regions have the potential to become 'another Middle East', they are important in the sense that they can provide supplies on the margin. And Indian requirement is not so huge that it cannot be met by these new sources.

Freight economies

Recently, there have been attempts by the Indian refineries to take crude from areas like Venezuela, Nigeria, and North Sea. In fact, IOC (Indian Oil Corporation) has signed a long-term contract with Nigerian National Oil Company for supply of crude. But given the huge ocean freight involved in transporting crude oil from such distant locations, these sources will remain at the margin. Hence, our strategy depends on future development of the tanker market, which may result in lower freight from these locations and the volume of our imports from these sources, which may result in substantial economies of scale.

Political instability

Even these countries/areas are not free from civil unrest. Caspian Sea is engulfed in a border dispute among Middle East countries and Algeria and West Africa have a history of civil unrest.

Option II - Development of equity oil abroad

Another option in enhancing our oil security is to encourage indigenous oil companies to explore in other countries thereby increasing the equity oil. The OVL (ONGC Videsh Limited), which has got stakes in various oil fields around the globe, is a good example of such an attempt and needs encouragement from the government. But the feasibility of bringing this oil to India either directly or indirectly (under Swap arrangements) needs to be analysed.

Option III – Giving equity in refining and marketing

PDVSA and Pemex (Venezuelan and Mexican national oil companies, respectively) have invested via joint ventures in increasing the size and complexities of the US refineries. By enlarging the nearby, higher valued market for their poor quality crude, Venezuela and Mexico have leveraged the value of large segments of their crude. India can also look at this option by allowing equity in its refining and marketing set-up to the multinational oil companies which have access to various production centres thus reducing the supply disruption risks to the economy, though the import dependency may remain.

Option IV - Strategies to restrict oil imports

Through intensive and focused oil exploration and production, it may be possible to boost the domestic oil reserves and hence reduce our dependence on oil imports. NELP (New Exploration and Licensing Policy) is a right step in this direction and though the response has not been quite as expected, it is essential to continue it. Hence, analyses of governmental policies that hinder the development of domestic exploration and production is also imperative.

Private oil companies are of the view that government policies and procedures are not transparent and the government reserves the best prospective fields for the national oil companies. This viewpoint needs to be corrected if India has to attract foreign investment in domestic exploration and production sector.

Then there are issues of profit repatriation, transfer of technology, eminent domain and higher tax rate, which hinder foreign investment in the oil and gas sector.

Short-term oil security

The short-term oil security is no less important because even a short-lived disturbance can de-rail the economy and push it into recession. The price shocks during the Gulf War was one such example of sudden and unexpected price

increase that we were not prepared for and hence led to sharp increases in our import bill. A widely followed strategy, inter alia, to prevent such disturbances is to have strategic petroleum reserves that can be drawn down in case of a national emergency.

Emergency stocks

Emergency stocks are the stocks that can be drawn down in the event of national emergency or even in a sub-crisis situation. The stocks can be divided into three types based on ownership.

Government stocks: These are the stocks held by central government or any other governmental agency exclusively for civil emergencies.

The main advantage of these stocks is that the government has the complete control over the storage, release, and use of the stocks and the management is unified under central control. However, it may place heavy financial burden on the government and may not be flexible enough to be released on time.

Agency stocks: These stocks are held under a co-operative-cost sharing arrangement by either a public or a private body or by a specialised stockholding agency.

The main advantages include management of stocks by oil industry expertise, harmonisation of differing industry interests, transparency of costs and flexibility in storage and distribution arrangements. However, they are also saddled with high initial costs and with need for arbitration of different interests.

Company stocks: These are the stocks maintained by the individual oil companies. These are again of two types: commercial stocks (those that are held purely for commercial purposes) and strategic stocks (those that are required under law to be held by the companies).

The main advantages are the benefits to be gained from industry expertise in storing and distributing crude and products and flexibility for the industry to keep the stocks for operational and strategic purposes. Disadvantages include dependency on industry locations, possible distortion of the market especially for small firms and difficulty in reconciling the different interests of refiners and traders.

Stockholding

The critical issue for a country is to decide which type of stock to maintain- company, country or agency stocks. Analysis of policies of various OECD countries does not give a clear answer and there are different combinations of types of stocks held by each country.

In the OECD, eleven net importing countries like Australia, Austria, Belgium, Greece and New Zealand, among others hold only company stocks apart from three net oil exporters: Canada, Norway and United Kingdom. Two net importing countries, Japan and United States hold both company and government stocks. Six net importing countries, Czech Republic, Finland, France, Hungary, Netherlands and Spain hold both company and agency stocks, apart from Denmark which is a net oil exporter. Only two countries, Germany and Ireland, hold all company, agency, and government stocks. Overall, the percentage of company stocks has declined from 89% in 1980 to 67% in 1999 whereas that of government stocks has increased from 7% to 25% over the same period.

The recent trend is towards using government stocks before industry stocks where government stocks are used to pacify the sub-crisis situation. It is also important to decide whether the government should impose statutory requirement on the companies to hold emergency stocks. Most of IEA member countries impose compulsory stockholding requirements on companies except Canada, Australia, United States, Czech Republic Germany, Hungary, Ireland, and New Zealand for various reasons.

Stock structure: crude vs products stocks

An important issue to be settled is the choice between crude and product stocks. Holding crude oil stocks is cheaper than holding product stocks. Crude oil stocks are technically easier and least expensive to maintain. Secondly, crude oil can be converted to all products, given a certain degree of refinery flexibility and spare capacity. Thirdly, quality considerations are not very stringent in case of crude oil stocks, unlike the product stocks.

Product stocks, on the other hand, have the advantage of bypassing the limitation imposed by refinery configuration and crude yield pattern. Response to meet the demand is more immediate if a country is holding substantial product stocks.

One more issue is which products to store. This can be very complicated if the product demand is seasonal. The European Stockholding Regulations foresee three categories of products for which the countries have to hold 90 days

of consumption – motor spirit, middle distillates and fuel oil. Nevertheless, EU members are allowed to check the need for further diversification of stocks to meet the demand in individual product.

IEA emergency stocks are evenly split between crude oil and products but there are wide disparities between countries. At one end, there is Japan and United States that primarily hold crude oil stocks. At the other end are Luxembourg and Switzerland that hold product stocks as they are land-locked countries and are heavily dependent on product imports.

Generally, industry stocks have relatively high portion of product stocks that are used to cater to the seasonal variations in demand whereas government-owned storage stocks are primarily crude oil stocks.

Demand restraint measures

Demand restraint refers to measures to achieve short-term oil savings during a crisis. The measures to achieve demand restraint falls into three main classes.

1. Persuasion and public information
2. Administrative and compulsory measures
   - Reduced speed limits
   - Car pooling
   - Driving bans either on particular days or based on even and odd car registration numbers.
   - Carless days
   - Limited service station hours
   - Restriction on lighting
3. Allocation and rationing schemes

Issues in demand restraint measures

- The policy issue in demand restraint measures is deciding the priority in using these measures and in deciding the trigger point for each of the measure, which in turn will depend upon the seriousness of the crisis.
- The effectiveness of the demand restraint measures is dependent on the fuel-switching capability of the country. However, not many countries can boast of having a decent fuel switching capability since a substantial part of oil is used in the transport sector where substitution possibilities are marginal.

Most IEA countries have statutory powers to initiate demand restraint measures in sub-crisis and emergency situations. In some cases, response depends on whether supply shortfalls are judged to cause national emergency.

National persuasion schemes to reduce the oil demand are expected to be widely in use in oil supply disruptions. The target of persuasion varies in each country, ranging from general public to specific users. As the lead-time for these measures is very small, clear-cut policies and quick decision making are some of the important factors affecting its effectiveness.

As mentioned above, the demand restraint measures also depend upon the fuel-switching capability of the economy. A number of LNG (Liquefied Natural Gas) terminals are planned along the east and the west coast of the country but their status is not encouraging. However, the use of LNG also depends on our fuel switching ability which is limited to power and fertilizer plants. Our transport sector is still heavily dependent on oil and measures should be taken to increase the alternatives for this sector as well. Introduction of CNG (Compressed Natural Gas) and LPG as a fuel for automobiles is a step in the right direction.

Stockdraw versus demand restraint

There is no clear policy consensus among the OECD countries regarding the priority of these two response mechanisms. Australia, Austria, Belgium, France, Italy and Spain are of the view that demand restraint measures should be used as the main response in early stages of disruption with stockdraw as the measure of last resort. Unites States is prepared to draw down the stocks in early stages of supply disruption in order to calm down the market. This is closely related to the difference between sub-crisis and emergency situation policies. The responses in these situations would depend, inter alia, upon the valuation of the seriousness of the situation by the government.

Strategies to enhance Indian oil security

In light of the above-mentioned issues this paper attempts to present a few broad strategies that could be considered to enhance India's oil security.

Strategic reserves

As yet, India does not hold strategic stocks for emergency purposes. Refineries hold crude stocks amounting to 10 - 16 days of consumption and product stocks of 30 - 45 days of consumption are held by oil companies. However, they are hard to be classified separately into commercial and strategic stocks because of which it is difficult to estimate separately the costs of building the strategic petroleum reserves.

The Ministry of Petroleum and Natural Gas recently prepared detailed study of the storage options at various locations across the country. The total capital cost of a storage facility including a terminal, pipelines and tankage varies from Rs 1 700 crore to Rs 2 300 crore. In addition, there is an annual operating cost of the order of Rs 35 crore. Then there is the cost of crude inventory itself. Going by current standards, we need to hold 8475 TMT of crude oil reserves, for 30 days of cover, which means crude cost would aggregate Rs 7 450 crore at current crude prices ($25/bbl).

Mobilising resources for strategic reserves

Mobilising adequate resources for the same, is thus, critical. One option is to finance the stocks through duties on crude and petroleum products. Another school of thought purports that such emergency stocks should be financed through general taxes rather than imposed as a hidden cost in oil prices to oil consumers. Since it is the citizens of the country that would be benefiting from the stockdraw, it is they who have to share the burden. Other alternatives for mobilising resources that could be considered are:

Industry stocks

Perhaps the easiest way to get over the problem of mobilisation of resources is to consider company-held stocks. It may be noted that within the IEA member countries too, stockholding obligations are met exclusively by industry stocks in eleven countries. Further all IEA member countries hold company stocks as a part of emergency stocks. As mentioned above, oil marketing companies in India already hold stocks to cover 30-45 days of supply. Costs for incremental storage would, thus, be minimal if the industry itself is entrusted with this task, as investments could be apportioned against the large sales volumes of the oil companies. The marginal costs for augmenting the cover could be subsequently recovered through appropriate price increases.

Oil Industry Development Board

Alternatively, the government could explore funding of emergency stocks via funds from the OIDB (Oil Industry Development Board). In 1989, the Government of India introduced a cess at the rate of Rs 900/MT on domestic crude oil production and used this levy create a fund for development of oil sector under the Oil Industry (Development) Act, 1974. The amount of cess so collected was to be made available to the OIDB.

However, an audit undertaken by the Comptroller and Auditor General of India noticed that out of Rs 31 000 crore collected towards cess up to March 1998, the Government of India passed on only Rs 902 crore to the OIDB and retained the balance of Rs 30 098 crore in government account. The levy of cess was being charged from the consumers in terms of increased costs. However, oil companies were not provided with funds generated through cess collection of Rs 30,098 crores. This resulted in commercial borrowings, thus, increasing operating costs, which, in turn, were again passed on to consumers through higher prices of petroleum products.

As is evident from the above, the penalty is being paid by the final consumers. First in terms of higher crude costs for refineries (reflected in higher product prices) and then again in terms of higher product prices on account of higher borrowing costs for oil marketing companies due non-availability of funds from the OIDB. At the outset, thus, the above-mentioned cess collection should be used for the development of the oil industry; more so on account of recent developments. In the Union Budget for 2002/03, the cess on crude oil has been further increased to Rs 1 800/MT. At current production rates annual cess collections are likely to be of the order of Rs 5 500 crore. The government could, thus, explore the possibilities of funding development of strategic reserves for the country from OIDB funds, instead of levying additional duties or taxes for the purpose.

Private investment

Given the large investments required for creating storage facilities, the government could also consider encouraging private investment in such facilities. Private contractors who put up these facilities may be assured of committed throughputs (storage) and remunerative rentals. Private investors have already put up tankages for storing petroleum products/chemicals at various ports across the country. Such facilities are available for lease to interested parties. Typically rentals range from Rs 150/kilolitre/month to Rs 200/kilolitre/month. A similar arrangement could also be considered for crude storage.

Management of strategic reserves

The task of managing strategic reserves should ideally be entrusted to a dedicated agency set up for that purpose. Management of strategic reserves is a complex issue involving establishment of drawdown procedures; drawdown rates; stock replenishment; inventory holding and maintenance; stock reporting;

establishment of early warning systems for crisis situations; monitoring of international trade in crude oil and products; etc. Given the comprehensive set of tasks involved, the government should consider instituting a specific agency dedicated towards management of strategic reserves.

Refinery configurations

With the Persian Gulf as the closest supply source of crude for imports, traditionally, Indian refineries have been configured to process primarily Middle Eastern crudes. The same preference today has become a cause of concern. There is a need to diversify the crude mix of the country to enhance oil security. However, the decision to diversify the crude mix must be preceded by a conscious decision to modify refinery configurations as well, especially for proposed grass-roots refining projects. For instance, in order to avail discounted crude offerings from Venezuela and Mexico, the complexity of the refinery would have to be enhanced to process heavier crudes and yet match current yield patterns.

Thrust on the East Coast

The country's energy security is at a peril on account of concentration of energy infrastructure on the west coast, be it with regard to refineries; tankages or pipelines (oil and gas both). The concentration of infrastructure in one region only also makes the country vulnerable to internal threats. There is an immediate need to develop alternative options to deliver crude and petroleum products hinterland from the east coast as well. Towards this end, the government should take the initiative in planning future installations on the east coast of the country.

Need for a regulator

With deregulation in the industry, prices of petroleum products would be determined by market forces. However, in areas where there has been virtually state monopoly in the past, the efficacy of market forces alone in delivering competitive prices remains questionable. While there can really be no price regulation per se in a deregulated industry, there does emerge an urgent need for a regulatory body to be institutionalised that could look into aspects of profiteering and fair prices in a deregulated environment.

The regulator would have a more visible role in ensuring availability of petroleum products. An emergency situation would warrant co-ordination across several organisations - ministries; oil industry; railways; port authorities;

state governments; etc. The regulator would have a critical role to play in ensuring overall direction and guidance in accordance with prescribed government policies for such a situation.

State governments would also have a critical role to play in assuring adequacy of supplies. The machinery put up to tackle a crisis situation should have a clear demarcation of responsibilities between the regulator body as an apex co-ordinating agency at the centre and state civil supply departments at the actual field level to assure a smooth flow of products to markets and consumers.

Structuring India's Emergency Response Policy and Organisation

Ostensibly, the most visible deterrent to any threat of disruption in oil supplies of a nation is the recourse to draw on strategic stocks. Building and operationalising strategic reserves, though, is a onerous task. Key elements to be considered while devising India's emergency response policy and organisation are:

- National emergency organisation structure
- Legal instruments: Decrees, executive orders, or legislation
- Stockholding and stockdraw

Even within the IEA (International Energy Agency) member countries, there is a considerable degree of heterogeneity on the above-mentioned aspects. For instance, there are countries with *in place* dedicated NESO (National Emergency Sharing Organisations), while there are others wherein the Government has the power to establish a NESO as and when required. There are considerable variations in legal instruments used to create these organisations and the powers conferred on the NESOs by these instruments. In stockholding, some countries rely solely on Government stocks while there are others with company or agency stocks. In devising India's emergency response policy, all such considerations have to be addressed.

National Emergency Organisation

Typically most IEA member countries have set up dedicated permanent structures (NESOs) to oversee supply and distribution of crude oil and petroleum products in crisis situations, viz., the National Oil Board in Belgium; the ESAB (Energy Supplies Allocation Board) in Canada; the DIMAH (Directorate for Raw Materials and Hydrocarbons) in France; the Executive Board in Italy; the OIEC (Oil Industry Emergency Committee) in United Kingdom, etc. The NESOs are, in general, subordinate to their respective energy ministries.

In the event of a crisis situation, a much larger emergency organisation is mobilised with personnel from oil companies; transport organisations; federal and local governments, etc. The French government, for instance, is committed to rapidly put in place special funds to reinforce DIMAH in personnel and equipment in a crisis situation.

NESOs typically perform the following activities:

- Monitor market developments to develop early warning systems
- Develop plans for implementing crisis management systems
- Maintain links with relevant government departments and other professional bodies involved in implementation of crisis measures
- Co-ordinate and implement emergency response in a crisis situation

Legal instruments

Most IEA countries have established national legislation to institute NESOs and to define their powers, roles and functions. A review of legal basis for emergency response organisations in select countries is presented below:

Table 1 Legal basis for emergency response organisations

Country	*Legislation*	*Powers*
Australia	Liquid Fuel Emergency Act 1984	Provides a comprehensive national approach to manage sever fuel shortage
Canada	The Energy Supplies Emergency Act of 1978/79 amended in 1990 The Emergencies Act of 1998	Provides primary basis for the Canadian Federal Government to respond to oil emergencies Basis for establishing ESAB which has necessary powers to impose demand restraint, allocate crude oil and products, ration gasoline and diesel, etc
France	The Law No 92-1443 of 1992	Confers necessary powers to DIMAH for implementation of IEA's IEP measures, demand restraint and allocation
Germany	The Energy Security Law of 1974	Provides all powers for implementing IEP measures
Japan	The Establishment Law of the Ministry of International Trade and Industry	Provides wide powers including the ability to establish a NESO in the Agency of National Resources and Energy
United Kingdom	The Energy Act of 1976	Provides powers to set up a National Oil Board under the authority of the Secretary of State for Trade and Industry
The United States	Executive Order 11912 as amended. The DOE Organisation Act. The Energy Policy and Conservation Act	The President, by the Order, authorises DOE to function as the NESO

The legal basis for stockholding obligations varies. In some countries, the provisions governing stockholding and stockdraw have been covered in the above-mentioned legislations itself, while for others there are separate

legislations to cover these aspects. For instance, stock obligations for Germany are separately covered in the Oil Stockholding Law of 1978 and those for Japan in the Petroleum Stockholding Law (1978 and 1995) and the Japan National Oil Corporation Law of 1983.

Stockholding and stockdraw

Again there are considerable variations within the IEA member countries on stockholding provisions. First and foremost, the onus of stockholding itself varies ranging from solely government owned stocks to a mix of industry and agency stocks. However, there is some degree of homogeneity wherein the law, in general, defines the following - stockholding obligations for different operators, i.e., government, industry or an agency; stock structures – crude/products; days of cover; etc.

On the operational aspects of stockdraw, the legislation, in general, confers broad powers to the concerned Minister with regards to use, distribution, physical placing of stocks and even price equalisation. In Belgium these powers are exercised by the Minister of Economic Affairs; in France, the Minister for Energy; in Germany, the Federal Minister for Economic Affairs; in Japan, the Minister for International Trade and Industry, and so on. The US legislation confers the powers to drawdown the Strategic Petroleum Reserve to the US President. However, the Energy Policy and Conservation Act does define "severe energy supply interruption", a key criterion used by the President to decide use of the strategic reserves.

The way forward for India

First and foremost would be the decision on the structure of the national emergency organisation for the country. While there are several alternatives possible, the overall responsibility for planning and responses to an oil crisis may be vested with a Crisis Management Group. The main advantage is that the Group could be convened rapidly and would provide a forum for quick discussion and collective decision-making on any aspect of response to an oil crisis. Additionally, an apex Board may be set up that serves as a permanent secretariat to this committee and undertakes the functions of a NESO as identified above.

Given the nature of the problem, the proposed set up must draw its authority from an Act of Parliament. It is essential to enable new legislation specific to oil

security issues that confers relevant powers to the proposed set up. Legislative support would have to be drawn for,

a) instituting the national emergency organisation, and
b) setting stockholding obligations and stockdraw procedures.

Legislative support for stockdraw is essential given the financial implications associated with large inventories for oil companies. The drawdown from strategic reserves is affected at market determined rates. Oil prices could be very volatile in a crisis situation. In such a scenario, timing is critical. There should be, thus, absolute clarity in allocation of reserves.

In terms of the stockholding obligations itself, the government may want to consider company held stocks (an option exercised by many IEA countries). Industry stocks are already within the distribution chain and so would reach the markets quickly in the event of a crisis situation. Moreover, given that oil companies in India already hold stocks representing 30-45 days of cover, the cost of additional stockholding would be marginal. Of course, there would have to be strict procedures laid down for auditing and reporting of stocks and the parameters for classifying strategic and commercial stocks of companies. Such tasks would have to be managed and co-ordinated by the proposed secretariat.

As is evident from the above, there are several issues involved in structuring an emergency response policy and organisation for a country. Some pointers have been offered in the preceding discussion. However, there remains a need for a more detailed study to examine all the options available and recommend a suitable strategy for India.

International Conference on Oil and Gas Security

31 May – 1 June 2002, New Delhi, India

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R K Pachauri

Dr Rajendra K Pachauri was born in Nainital, India, on 20 August 1940. He assumed his current responsibilities as the head of TERI (Tata Energy Research Institute) in 1981, first as Director and, since April 2001, as Director-General. TERI does original work and provides professional support in the areas of energy, environment, forestry, biotechnology, and the conservation of natural resources to government departments, institutions, and corporate organizations worldwide. Dr Pachauri has been elected as Chairman of IPCC (Intergovernmental Panel on Climate Change), established by World Meteorological Organization and United Nations Environment Programme in 1988. He has taken charge as Chairman, IPCC from 20th April 2002 onwards. He has been active in several international forums dealing with the subject of climate change and its policy dimensions.

To acknowledge his immense contribution to the field of environment, he has been awarded the **Padma Bhushan** - one of India's highest civilian awards that recognizes distinguished service of a high order to the nation in any field (January 2001).

Commencing his career with the Diesel Locomotive Works, Varanasi, where he held several managerial positions, Dr Pachauri joined the North Carolina State University, Raleigh, North Carolina, USA, where he obtained an MS in Industrial Engineering in 1972, a PhD in Industrial Engineering and a PhD in Economics, and also served as Assistant Professor (August 1974–May 1975) and Visiting Faculty Member (Summer 1976 and 1977) in the Department of Economics and Business.

On his return to India, he joined the Administrative Staff College of India, Hyderabad, as Member Senior Faculty (June 1975–June 1979) and went on to become Director, Consulting and Applied Research Division (July 1979–March 1981). He joined TERI as Director in April 1981.

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He has also been a Visiting Professor, Resource Economics at the College of Mineral and Energy Resources, West Virginia University (August 1981-August 1982); Senior Visiting Fellow, Resource Systems Institute, East-West Center, USA (May-June 1982); and Visiting Research Fellow, The World Bank, Washington, DC (June-September 1990). Recognising his vast knowledge and experience in the energy-environment field, the United Nations Development Programme appointed him as a part time Adviser in the fields of Energy and Sustainable Management of Natural Resources, 1994-1999.

His wide-ranging expertise has resulted in his being invited to join various international and national committees and boards, which on the international level include Member, Board of the International Solar Energy Society (ISES), 1991-1997; Member, World Resources Institute (WRI) Council, 1992; Chairman, Work Group A - World Energy Council (WEC) Committee on Developing Countries, 1993-1995; President (1988), Chairman (1989-90), International Association for Energy Economics (IAEE), Washington, D C .; President, Asian Energy Institute, 1992 onwards.

Committees of the Government of India which he has served include Member, Panel of Eminent Persons on Power, Ministry of Power; Member, Delhi Vision - Core Planning Group; Member, Advisory Board on Energy (ABE), Government of India, 1983 - 1988 (The Board reported directly to the Prime Minister of India); Member, National Environmental Council, Government of India under the Chairmanship of the Prime Minister of India, November 1993 and April 1999; Member, Oil Industry Restructuring Group, "R" Group, Ministry of Petroleum and Natural Gas, Government of India, 1994.

He has also served on academic and research institute bodies including Member, Board of Governors, Trireme Scientific & Industrial Research Foundation, September 1987; Member, Executive Committee of the India International Center, 1985 onwards; Member, Governing Council of the India Habitat Center, New Delhi, October 1987 onwards; Member, Court of Governors, Administrative Staff College of India, 1979-81.

In January 1999, Dr R K Pachauri was appointed as Director, Board of Directors of the Indian Oil Corporation Limited (a Fortune 500 company) for a period of 3 years.

In April 1999, Dr R K Pachauri was appointed as the Member, Board of Directors of the Institute for Global Environmental Strategies (IGES), Environment Agency, Government of Japan, for a period of 3 years.

In September 1999, Dr R K Pachauri was appointed as the Chairman, The Darjeeling Himalayan Railway Heritage Foundation, Darjeeling.

He taught at the School of Forestry & Environmental Studies, Yale University, USA, as McCluskey Fellow during 6 September–8 December 2000.

In July 2001, Dr R K Pachauri was appointed Member, Economic Advisory Council to the Prime Minister of India.

He has also authored 21 books and several papers and articles.

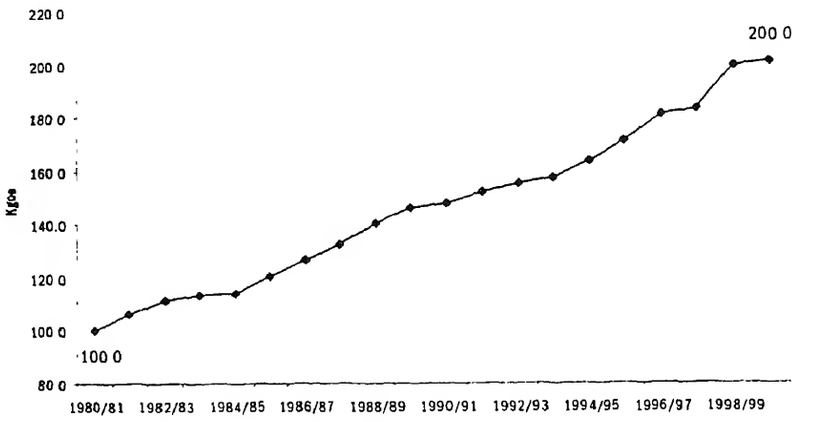
India's Energy Security

Dr R K Pachauri
Director General, TERI
May 31, 2002

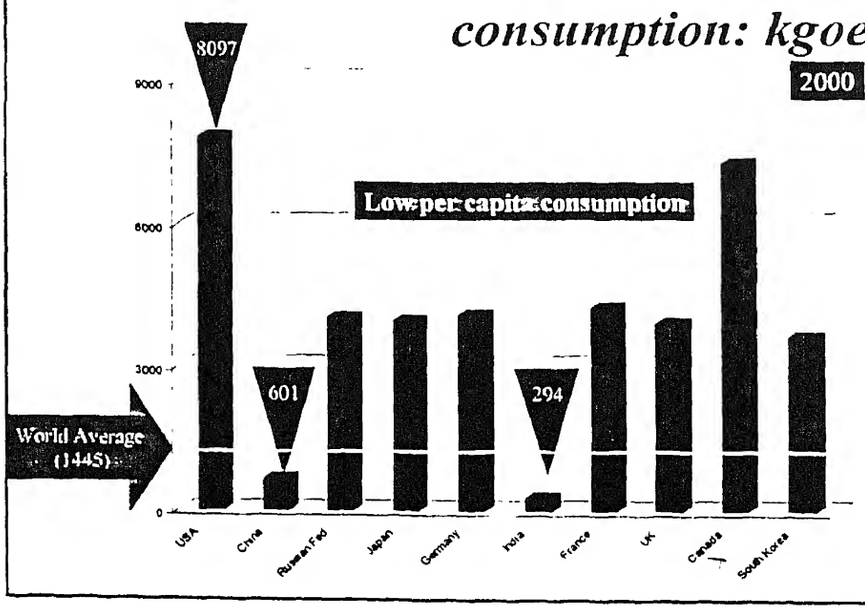
Outline

- Energy overview
- Diversifying fuel mix
- Short-term supply disruptions
- Emerging technologies
- Strategic alliances
- Regional cooperation

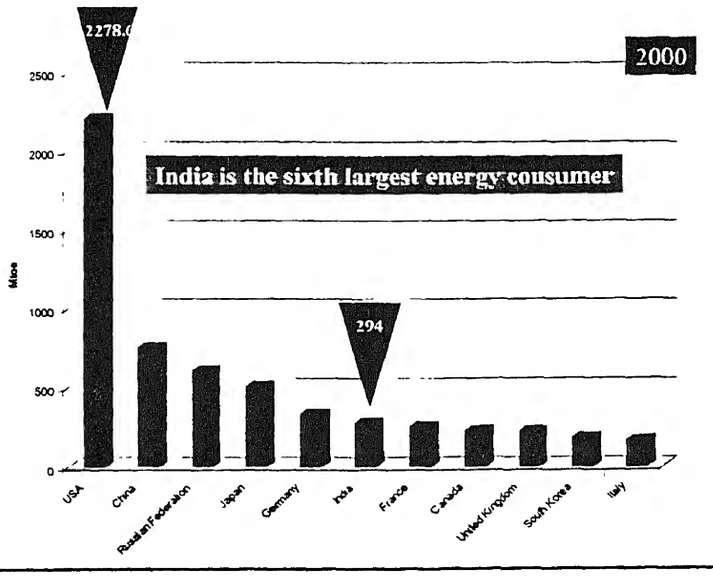
Per capita net commercial energy consumption in India (kgoe)



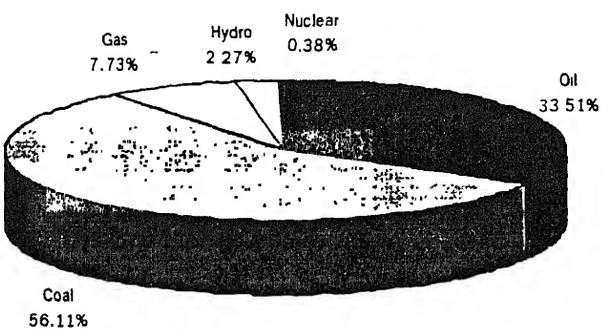
Per capita primary energy consumption: kgoe



Total energy consumption: mtoe



India Fuel mix: 2000/01



Total primary energy supply: 294 Mtoe

Fuel types

- High import dependence
  - Oil
  - Gas
- Low import dependence
  - Coal
  - Hydro
  - Nuclear

Share of energy (%)

Year	Coal	Oil	Gas	Hydel	Nuclear
2001-02	50	32	15	2	1
2006-07	50	32	15	2	1
2010-11	53	30	14	2	1
2024-25*	50	25	20	2	3

* Hydrocarbon Vision 2025

Coal

- Prognosticated reserves: 211.6 billion tonnes
- Reserve quality
  - High ash content & low calorific value
  - Concentrated in Eastern & South Eastern region
- Coal consumption in 2001/02: 354 MMT
- Coal demand -supply balance (MMT)

Year	Demand	Supply	Deficit
2006/07	511	400	-111
2011/12	620	573	-47

Tenth Plan Working Group

Demand projections:
Oil and Natural Gas

Year	Crude oil (MMT)	Natural gas (MMSCMD)	Refining capacity (MMT)
2001/02*	98	117	114
2006/07**	123	165	220
2011/12**	169	216	260
2024/25***	276	322	358

* Actual sales

** Tenth Plan Sub Group Report

*** Hydrocarbon Vision 2025

Power

- Installed capacity as on 31st March 2001: 1,01,630 MW
- Energy and peak demand outlook (16th EPS)

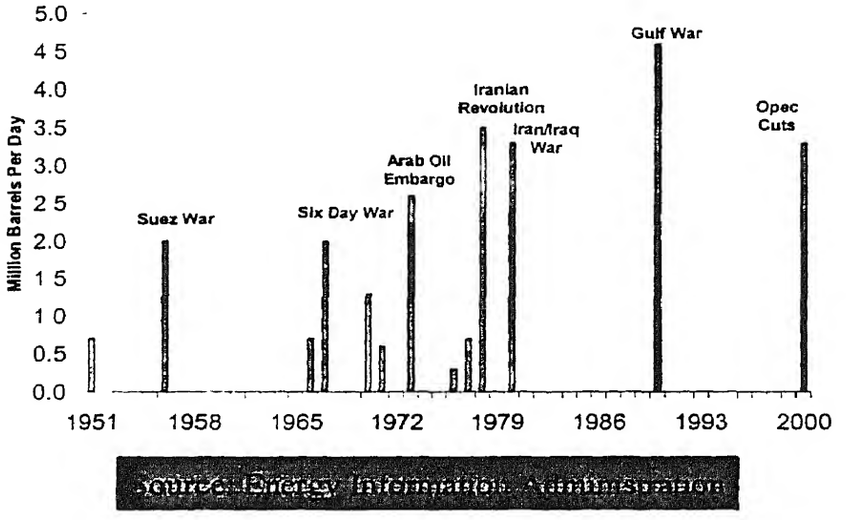
Year	Peak load (MW)	Energy required (MU)
2006/7	115705	719097
2011/12	157107	975222

- Proposed capacity additions to fall short of requirements
- Peak and energy shortages likely to continue

International Oil Market

- Possible disruptions in supply
- Price fluctuations
- R/P ratio of 41 years

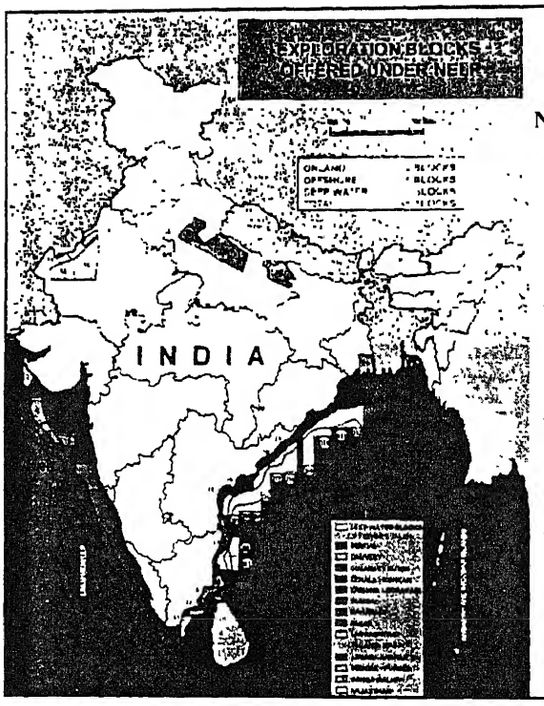
Major disruptions in energy supply



Source: Energy Information Administration

Domestic resources

- Balance recoverable reserves
  - 645 MMT
  - R/P ratio: 20.18 years
- 26 sedimentary basins
  - 6 moderately explored
- Private participation
  - 48 blocks awarded under NELP - I / II
  - 27 blocks to be offered under NELP - III
  - 9% production from private/JV fields



Upstream policy

NELP

- Private sector participation in E&P through PSC
- Level playing field with NOCs
- Attractive fiscal package
- **NELP - I**
  - 48 blocks offered
  - 25 blocks awarded
- **NELP - II**
  - 25 blocks offered
  - 23 blocks awarded
- **NELP - III**
  - 27 blocks to be offered

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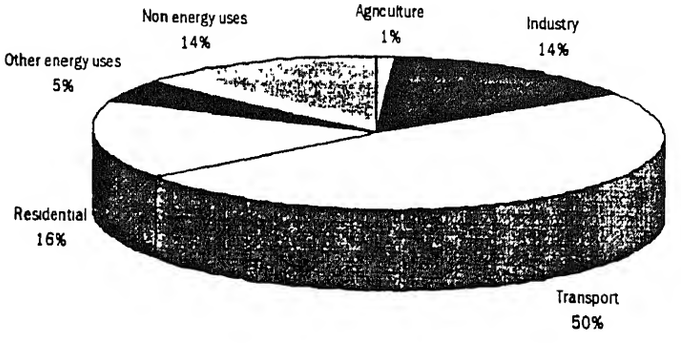
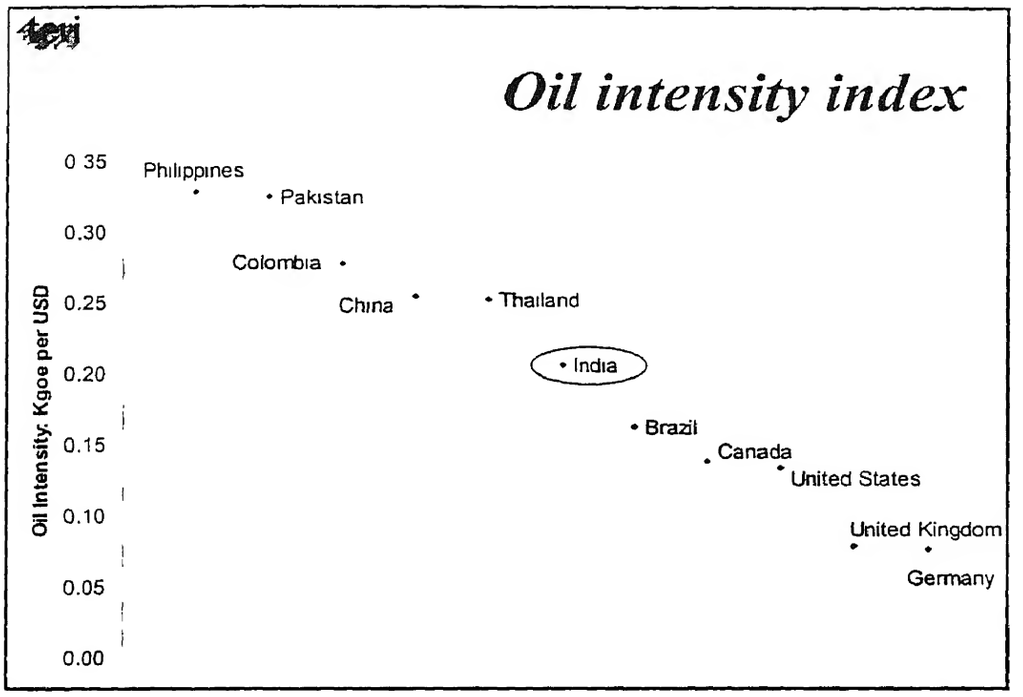
Sectoral use of oil: 1999/00

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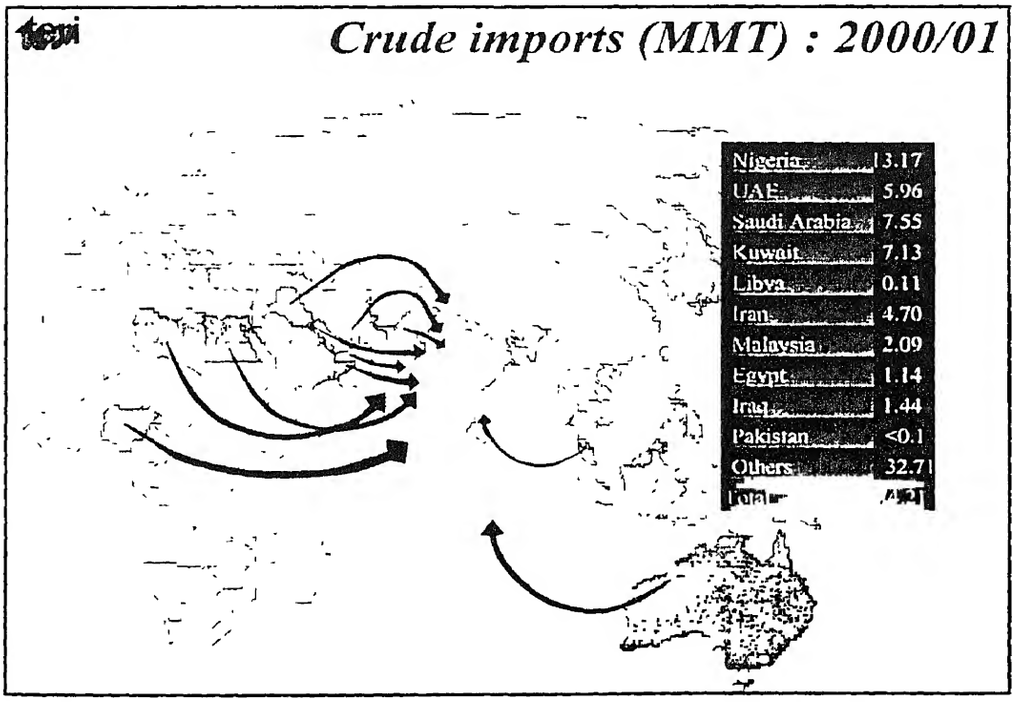
Oil intensity index
Oil Intensity: Kgoe per USD
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Philippines
Pakistan
Colombia
China
Thailand
India
Brazil
Canada
United States
United Kingdom
Germany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Crude imports (MMT) : 2000/01
Nigeria 13.17
UAE 5.96
Saudi Arabia 7.55
Kuwait 7.13
Libya 0.11
Iran 4.70
Malaysia 2.09
Egypt 1.14
Iraq 1.44
Pakistan <0.1
Others 32.71

Central Asia

Reserves

Country	Oil resources (billion bbl)			Gas resources (TCM)		
	Proven	Possible	Total	Proven	Possible	Total
Azerbaijan	3.6-11.0	27	31-38	0.3	1	1 3
Kazakhstan	10.0-16.0	85	95-101	1 5-2.4	2.5	4.0-4 9
Turkmenistan	1.4-1.5	32	34	2 8-4 4	4.5	7 3-8 9
Uzbekistan	0.2-0 3	1	1	2 1-2 5	1	3.1-3 5
Total	**15.4-29.0**	**163**	**178-191**	**6.7-9.6**	**9.3**	**16.0-18.9**

Central Asia – "No substitute to the Middle East"

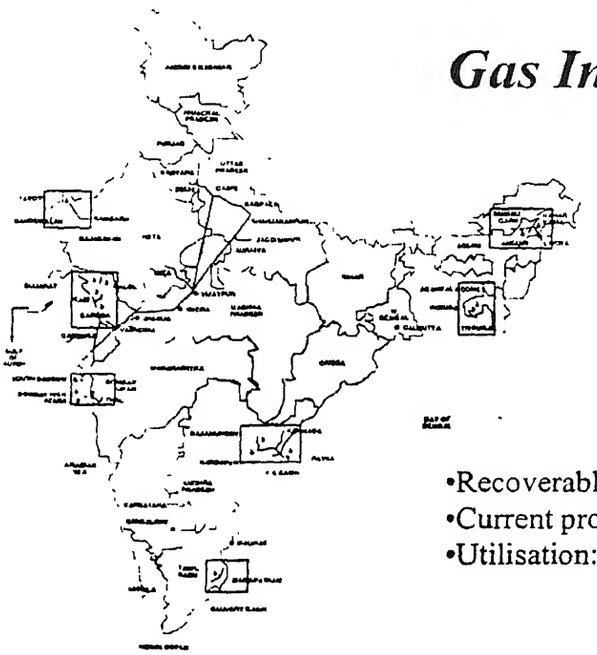
Equity Oil

- Vietnam
- Sakhalin
- Sudan
- Oman

Substitution by alternative technologies

- CNG
  - Delhi/Maharashra/Gujarat
- LNG-feasible by 2004
- Fuel cells - commercial by 2010
- DME - technology at experimental stage/being commercialized
- Ethanol-12.5% rebate given on surcharge for 5% blended petrol

Gas Infrastructure



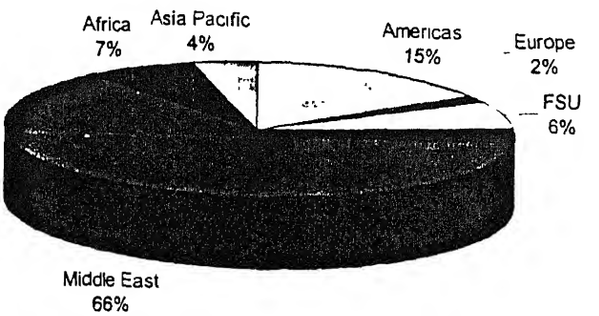
•Recoverable reserves: 648 BCM
•Current production: 78 MMCMD
•Utilisation: Power & fertiliser

1999

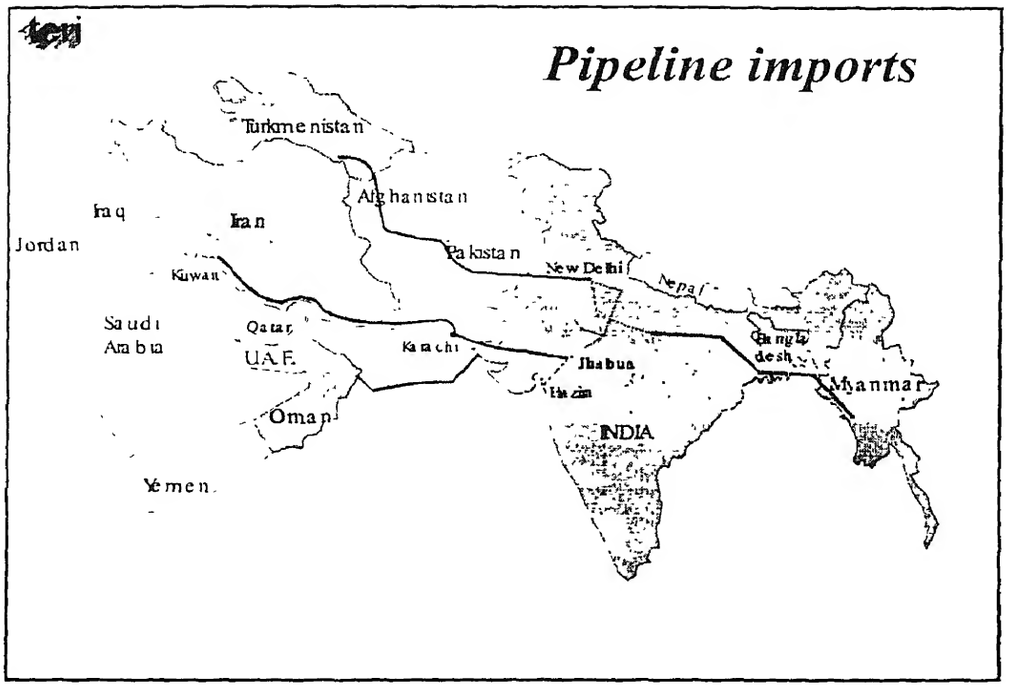
International Gas market

- No history of supply disruption
- Prices bilaterally agreed and more stable
- R/P ratio of 61 years

Resource base



Middle East: "Too big to ignore"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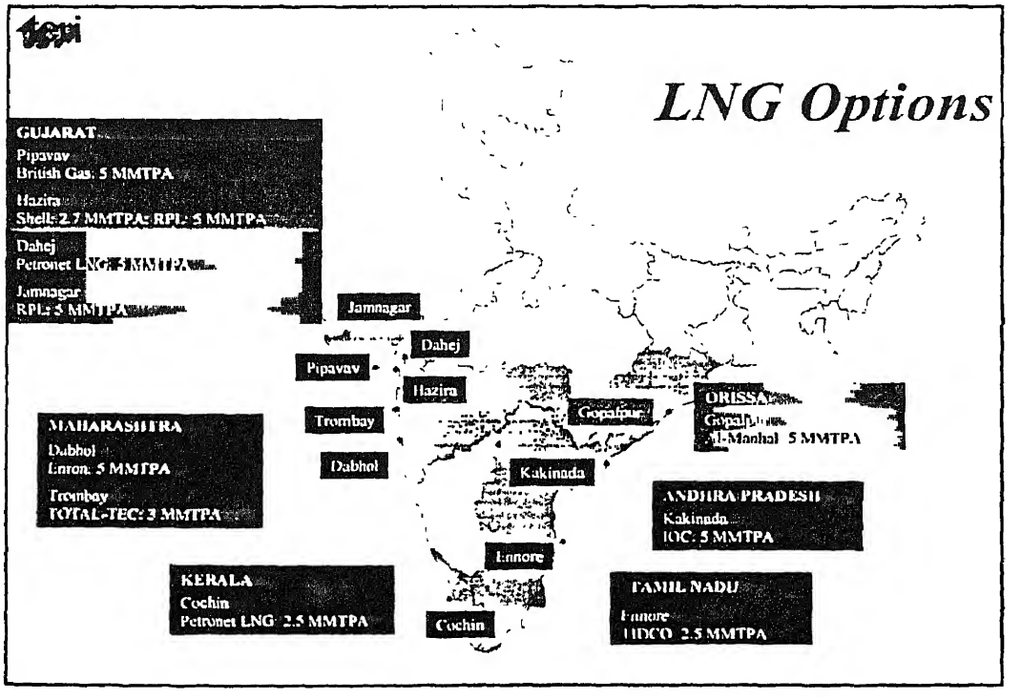
Pipeline imports
Turkmenistan
Afghanistan
Iraq
Iran
Jordan
Pakistan
New Delhi
Nepal
Kuwait
Saudi Arabia
Qatar
U.A.E.
Karachi
Jhabua
Hazira
Bangladesh
Myanmar
Oman
INDIA
Yemen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LNG Options
GUJARAT
Pipavav
British Gas: 5 MMTPA
Hazira
Shell: 2.7 MMTPA; RPL: 5 MMTPA
Dahej
Petronet LNG: 5 MMTPA
Jamnagar
RPL: 5 MMTPA
Jamnagar
Dahej
Pipavav
Hazira
Trombay
Dabhol
Gopalpur
ORISSA
Gopalpur
Tal-Manhal 5 MMTPA
MAHARASHTRA
Dabhol
Enron: 5 MMTPA
Trombay
TOTAL-TEC: 3 MMTPA
Kakinada
ANDHRA PRADESH
Kakinada
IOC: 5 MMTPA
Ennore
KERALA
Cochin
Petronet LNG: 2.5 MMTPA
Cochin
TAMIL NADU
Ennore
HDCO: 2.5 MMTPA

Future gas sources

- **CBM**
  - Assessed resources: 850 BCM
  - 7 blocks offered in April 2001
    - Raniganj
    - Bokaro
    - North Karanpura
    - East and West Shogapur
    - Satpura
    - North Barmar
  - Reliance, Essar and ONGC-IOC bagged the block
  - Ground work has been started for Round II
- **Hydrates**
  - Assessed resources: 6150 TCM mostly in deep waters
  - Production technology not yet proven
  - National Gas Hydrate Programme under implementation

Potential of Renewables

Sources/technologies	Units	Approximate potential	Achievements
Wind Power	MW	45,000	1,267
Small hydro power (upto 25 MW)	MW	15,000	1,341
Biomass power	MW	19 500	308
Biomass gasifiers	Nos	16,000	35
Biomass cogeneration	MW	3,500	273
Urban and Industrial waste based power	MW	1,700	15 2
Solar photovoltaics	MW/km2	20	47 (MW)
Solar water heating	million m2 collector area	140	0.55
Biogas plants	million	12	3.1
Improved biomass chulhas (cookstoves)	million	120	33

Renewables: Current & potential costs

Technology	Turnkey investment costs (US $ / kw)	Current energy cost (cents / kWh)	Potential future energy cost (cents / kWh)
Biomass electricity	900-3000	5-15	4-10
Wind electricity	1100-1700	5-13	3-10
Solar photovoltaic electricity	5000-10000	25-125	5 or 6-25
Solar thermal electricity	3000-4000	12-18	4-10
Hydroelectricity			
Large	1000-3500	2-8	2-8
Small	1200-3000	4-10	3-10
Geothermal electricity	800-3000	2-10	1 or 2-8
Marine energy			
Tidal	1700-2500	8-15	8-15
Wave	1500-3000	8-20	Unclear
Current	2000-3000	8-15	5-7
OTEC	Unclear	Unclear	Unclear

Hydro

- Installed capacity: 25,142 MW
- Share of hydro in capacity mix has declined from 43% in 1970 to 25% in 2001
- 84 000 MW assessed potential
- Additional potential
  - Imports from Nepal: 84 000 MW
  - Pumped Storage: 90 000 MW
- Impediments
  - Environment/rehabilitation
  - Long gestation periods

Nuclear

- Installed capacity: 2720 MW
- Target capacity by 2020: 20335 MW
- Impediments
  - Cost of production
  - Long gestation period
  - Dependence on Government support
  - Reactor safety & waste disposal

Strategic Alliances

- Gas hydrates technology with US and Japan
- Deep sea gas pipelines
- LNG buyers forum
- Transit agreements for transnational gas pipelines
- Focus on Central Asia
- Gas imports: Iran, Bangladesh and Myanmar

Regional Co-operation

- Joint / bilateral emergency stocks
- Information exchange
- Asian Gas Grid
- Policing of sea lanes of communication
- Joint diplomatic initiatives vis-à-vis Gulf oil producers
- Collaborative research on renewable technologies

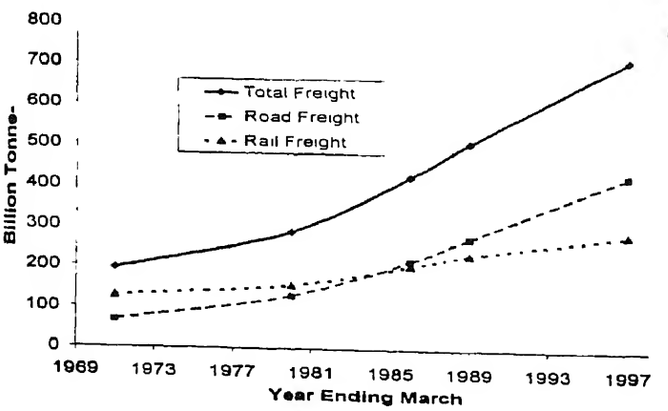
Characteristics of Indian transport sector

- Growing travel demand and shift from rail to road
- Absence of a good public transport system leading to increasing share of personal motor vehicles
- Increasing level of congestion and declining speed leading to poor fuel efficiencies of most transportation modes
- **Increased energy intensity in the transport sector has led to increased consumption of fossil fuels.**

Current status of share in Freight and Passenger Traffic

	Railways	Roads
Freight	40%	60%
Passenger	20%	80%

Inter modal share of freight traffic



Continuous erosion in the share of Railways in freight movement and increase in share of less efficient road transport

Need for Transport Policy

- Energy demand of transport sector should come down by taking actions in the right directions
- Diesel (consumed mainly in transport sector and captive power generation) demand should also come down in the long run
- **Need to promote integrated inter-modal transport system**

Hydrocarbons Security: India

- Political changes in producing countries
- Dependence of oil trade on few specific locations
- Price fluctuations in global market

Financing stocks

- Quantity: 30 days cover
- Crude costs
  - Rs 59 billion at $22/bbl
  - Rs 76 billion at $28/bbl
- Capital costs
  - For storing MS, HSD and SKO - Rs.23 billion over 15 years*

*Source. Sundararajan Committee Report (Figures inflated to the current year)

Thank You

Biographical Sketch
Member of Parliament
13th Lok Sabha

NAIK, SHRI RAM

[BHARATIYA JANATA PARTY - MUMBAI NORTH (MAHARASHTRA)]

Father's Name	Shri Damodar
Date of Birth	16 April 1934
Place of Birth	Sangli (Maharashtra)
Marital Status	Married
Date of Marriage	17 May 1960
Spouse's Name	Smt. Kunda
No. of Daughters	Two
Educational Qualifications	B.Com., LL.B. Educated at Brihan Maharashtra College of Commerce, Pune and Kishinchand Chellaram Law College, Mumbai (Maharashtra)
Profession	Political and Social Worker and Management Consultant
Permanent Address	9, Shiv Smriti, 51, Jai Prakash Nagar, Goregaon East, Mumbai-400 063 (Maharashtra) Tels. (022) 8732333, 8733339 Fax. (022) 8731133
Present Address	9, Teen Murti Marg, New Delhi-110 011 Tels. (011) 3017111, 3793080 Fax. (011) 3017112

Positions Held

1969-77	Organising Secretary, Bharatiya Jana Sangh (B.J.S.), Mumbai, Maharashtra
1977-78	General-Secretary, Janata Party (J.P.), Mumbai, Maharashtra
1978-89	Member, Maharashtra Legislative Assembly (three terms) Member, Public Accounts Committee; Estimates Committee; Privileges Committee; and Rules Committee, Maharashtra Legislative Assembly
1979-80	President, Janata Party (J.P.), Mumbai

1980-86	President, Bharatiya Janata Party (B.J.P.), Mumbai
1986-89	Vice-President, B.J.P., Maharashtra
1989	Elected to 9th Lok Sabha
1989-95	Member, Railway Convention Committee
1989-97	Member, Consultative Committee, Ministry of Railways
1990-91	Member, Committee on Science and Technology
1991	Re-elected to 10th Lok Sabha (2nd term)
1992-94	Member, Joint Parliamentary Committee on Securities Scam
1992-97	Member, Committee on Railways
1993-95	Chairman, Joint Committee on Catering in Parliament Complex
1995-96	Chairman, Public Accounts Committee
1996	Re-elected to 11th Lok Sabha (3rd term) (with highest votes and margin in Maharashtra)
1996-97	Chief Whip, B.J.P. Parliamentary Party Member, Business Advisory Committee Member, Committee on Railways Member, Joint Parliamentary Committee on Women's Reservation Bill Member, Committee on Empowerment of Women Member, Rules Committee Convener, Study Group of the Committee on Railways for suburban Railway services in Metropolitan cities
1998	Re-elected to 12th Lok Sabha (4th term) (with highest votes and also highest margin among six Lok Sabha Constituencies in Mumbai, and also the first Member of Parliament to get consecutively Elected four times in Mumbai)
1998-99	Union Minister of State, Railways (Independent Charge), Parliamentary Affairs, Planning and Programme Implementation and Home Special Invitee, General Purposes Committee Member, National Executive, B.J.P.
1999	Re-elected to 13th Lok Sabha (5th term) (with highest votes in Maharashtra)
13 Oct. 1999-onwards	Union Cabinet Minister, Petroleum and Natural Gas

Social and Cultural Activities

Slum improvement work in Mumbai's slums; participation in co-operative banking, urban credit societies, housing societies and educational institutions; pioneer in suburban railway commuters movement in Mumbai

Favourite Pastime and Recreation

Public service, reading, travelling, sports and games

Sports and Clubs

Played Indian games and basket ball at inter-college level

Countries Visited

France, Nepal, Sweden and U.K.; Member, 88th I.P.U. Conference, Stockholm, Sweden, 1992

Other Information

Succeeded in introducing national song, 'Vandematram' in Parliament and also in changing the name of Bombay to Mumbai; campaigned successfully resulting in sanction of Rs. one crore per annum per MP for suggesting development works in their constituencies; introduced a Private Member's Bill for promotion of breast-feeding and prohibiting advertisements of baby food which was debated in Tenth Lok Sabha and finally converted into an official Bill and passed

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Election Result of Mumbai North Lok Sabha Constituency

Total electorate	22,22,232
Total votes polled	9,54,260
Poll percentage	42.94%
Valid votes	9,18,529

Votes polled in favour of the first four leading candidates

(1) Shri Ram Naik	(B.J.P.)	5,17,941	56.39%
(2) Shri Chandrakant Gosalia	(I.N.C.)	3,63,805	39.61%
(3) Shri Damodar J. Tandel	(Ind.)	25,132	2.74%
(4) Shri Dabhade D. Pandurang	(Ind.)	7,459	0.81%

INAUGURAL ADDRESS BY SHRI RAM NAIK, MINISTER OF PETROLEUM & NATURAL GAS ON "OIL SECURITY MEASURES & RESPONSE MECHANISMS" ON 31st MAY 2002 AT NEW DELHI

Shri R.K. Pachauri, Director General, TERI, Shri Naresh Narad, Additional Secretary, Ministry of Petroleum & Natural Gas, distinguished delegates, friend from media, ladies and gentlemen,

Good morning and hearty welcome to all of you !

The Indian summer at its peak is an experience in itself. While the heat is energy sapping, I ponder over the tremendous potential of solar energy for meeting the energy needs of the world. I sincerely look forward to pioneering technologies that will enable the world to economically tap this virtually unlimited energy source.

I have just returned only this morning from a roadshow at Singapore to attract investment in 27 blocks offered under the third round of New Exploration Licensing Policy (NELP-III) and the steel cutting ceremony at Seoul in Korea for the first ever LNG ship for the Dahej Plant of Petronet LNG. Both these events are closely related to India's oil security. We have named the LNG ship as "Disha" which symbolises our resolve to give direction to the hydrocarbon sector.

The theme of the conference today is "Oil Security Measures and Response Mechanisms" and I would like to share my thoughts on this subject. As you are all aware, over the past couple of years, oil importing and developing countries like India have been facing challenges due to the high oil prices prevailing close to historical highs as a direct consequence of regulation in oil supplies by OPEC and other oil producing countries. More recently, the delicate political situation in West Asia, has been the area of major concern.

Before elaborating further on the subject, I would like to compliment Tata Energy Research Institute (TERI) for their initiative in organizing this international conference. I consider it a great privilege to address the distinguished gathering of eminent personalities from various walks of life on the energy security

concerns of our country. I extend my warm greetings once again to you all.

Oil and natural gas together account for two thirds of global energy consumption and, therefore, dominate the global energy sector. Given the rapid growth of natural gas consumption and its environmental friendly combustion properties, natural gas would dominate the energy sources during the 21st century. Gas is the fuel of this century. India presents a slightly contrasting picture with coal contributing about 56% of the energy consumption with oil and natural gas accounting for about 40%. The dominance of oil and to an extent gas in the transportation sector, is likely to see the increasing share of oil and gas in line with the international trend.

The energy security issue has two dimensions – supply security and price security. For an oil importing and developing country like India, which is dependent upon crude oil imports to meet 70% of its requirements, these issues are crucial and there is a need to address both of them. Out import Bill in the last financial year has been to the tune of Rs.68,000 crore.

On the supply side, there are favourable factors like oil being traded freely and without barriers across the world. However, unfavourable factors are the concentration of 65% of global oil reserves in the Middle East region, regulation of supplies by OPEC and other oil exporting countries and political disquiet in this region. While recent history has not witnessed consistent long duration supply shortages, including the gulf crisis of 1990, the threat of such disruptions do have a significant impact on oil prices.

On the price front, a sustained period of high oil prices has an adverse impact on the economies of oil importing and developing countries like India. The annual average of Dubai crude oil price during the year 2000 and 2001 was around US dollar 26 and 23 per barrel respectively, the highest annual average price during the last 10 years.

As you are aware the oil sector has been de-regulated from 1st April 2002. The administered price mechanism has also been dismantled simultaneously. May I take the credit for implementing this bold decision, which some cynics thought would not come on schedule? The Indian public and industry were accustomed to a

stable price regime over the past several years. As we integrate with the global economy and look forward to the benefits from the change, we should be aware of the difficulties that are to be faced in the short term. During this structural shift from a regime of controlled prices to free prices, the government would need to see that the consumers are not affected by sudden price spikes. A moderate approach that facilitates the customers adjusting to the reality of the international market place needs to be adopted.

As a consequence of the deregulation of the oil sector, marketing rights have been granted to four applicants i.e. Reliance Industries, Essar Oil, Oil and Natural Gas Corporation and Numaligarh Refineries Ltd. to set up over 8,000 Retail Outlets in the country. These outlets along with the outlets being set up by the PSU oil marketing companies will lead to a 60% increase in the number of Retail Outlets which are over 18,000 presently in the country. As the number of players increases in the downstream sector, there is a need for a retulatory framework to ensure a level playing field for the entities and also to see that the benefits of competition flow to the consumers. The Petroleum Regulatory Board Bill has been introduced in the Parliament during the Budget session. The Bill is now under consideration of the Standing Committee on Petroleum & Natural Gas. It is also available on website. We propose to have "Samvad" (interaction) with various interested organisations included the consumers' groups on the bill at important locations.

From the supply security, perspective, the government has a multi-pronged strategy to address the issues remedial action on short term. I would like to highlight a few of the strategies of the government and the initiatives taken in this regard. We have diversified the basket of acceptable crude oil in the refining system. Direct imports of crude oil undertaken with a number of oil producers have enhanced supply security. The oil industry is now free to import crude oils of its choice. While economics would dictate the sourcing of crude oils, I urge the oil industry in the country to accord due importance to supply security as well.

More important, are the long-term policy measures initiated by the government. These include opening up the exploration sector to private and foreign investment to encourage Exploration and Production (E&P) activities in our country and encouraging Indian oil companies to acquire acreages abroad. While the

gestation period in case of E&P activities is high, it is expected to pay rich dividends in the long run.

Opening up of the available acreages in India on yearly basis for active exploration by private and joint venture companies – both Indian and foreign, in addition to the national oil companies (NOCs) was launched in 1993, which was improved upon in 1999 through a highly liberalized policy known as New Exploration Licensing Policy (NELP) we are offering internationally competitive fiscal terms. Under the NELP, all companies, including the NOCs, are required to bid for committed work programme, profit petroleum share at various levels of pre-tax multiple of investments and percentage of annual production sought to be allocated towards cost recovery.

So far, two rounds of NELP i.e. NELP-I and II have been completed, wherein Production Sharing Contracts (PSCs) for 47 exploration blocks – 8 onland, 24 shallow offshore and 15 deep offshore blocks were signed in less than 6 months from the bid closing dates which is a major improvement over 2 to 3 years taken for signing of contracts earlier. While only 22 blocks were awarded earlier in 10 years, we have contracted for 47 blocks in the last two years. An investment of about Rs. 2,500 Crores is committed for the first phase of minimum work programme in the blocks awarded under NELP-I and II. The total estimated investment in these blocks for all the three phases of the entire exploration period of 7 to 8 years is of the order of Rs. 9,300 Crore. With the time bound implementation of the work programme in all the 47 contracted blocks, a total sedimentary area of about 5,00,000 sq. km. shall come under active exploration. In the past 2 years, a large volume of seismic data has been acquired in the NELP blocks using 16 ships. These exploration efforts have shown encouraging success and discoveries have been made in the Krishna-Godaveri deepwater block of Cairn Energy. Even with the existing exploration programme, more discoveries are expected in near future.

On 28th March, 2002 we have announced NELP-III, wherein 27 blocks – 11 onland, 9 deep water and 7 shallow water blocks, have been offered with bid closing date as 28.8.2002. The first roadshow was held in Delhi in April. As I mentioned earlier, I have just returned from the roadshow at Singapore. Three more roadshows are planned at London, Houston & Calgary in this fortnight. We are hopeful that with the improved data quality and attractive fiscal and contractual terms, companies will find the

offer interesting enough to participate in the bidding process for NELP-III. It is, thus, expected that with the operationalisation of the liberalized NELP route, more than 25% of the total sedimentary basin would be explored by 2005.

On the production front, in order to enhance the indigenous oil and gas production, an investment of about Rs. 10,000 Crore is planned by the Oil & Natural Gas Corporation (ONGC), towards implementation of various improved oil recovery (IOR) and enhanced oil recovery (EOR) schemes in their major aging oilfields, including the giant Mumbai High Field for optimal development of these fields. The redevelopment plan of Mumbai High North and South have already been launched in January 2001, October 2001 respectively.

For exploration of alternate source of energy, Government of India have recently given a thrust for Coal Bed Methane (CBM) exploration by awarding 5 CBM blocks in different parts of the country. For a country like ours, with a resource potential of about 1,000 Billion Cubic Metres (BCM) of gas from coal deposits, award of 5 blocks by international bidding is just the beginning of development of yet another source of energy. These contracts are expected to be signed soon. Two more blocks have also been given on nomination to a consortium of ONGC and Coal India Limited. One more block was awarded earlier to Great Eastern Energy Corporation.

Government have also taken a decision to mix 5% ethanol in petrol in the eight states of Uttar Pradesh, Punjab, Haryana, Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka in the first phase, to be followed by the entire country. The mix will increase to 10% after approval is received from the Bureau of Indian Standards. Research is on to demonstrate the feasibility of mixing ethanol in diesel. Use of ethanol as a fuel will reduce dependence on imported crude which will be substituted by a domestic product with added benefit of renewable source of energy.

To meet the growing gap of demand and supply of gas, momentum has been given to LNG imports in India. The Government of India have set up a new company, the Petronet LNG Ltd. (PLL), which is a joint venture among four top national oil and gas companies of India viz, GAIL, IOC, BPCL and ONGC. M/s PLL have identified two locations namely, Dahej (Gujarat) and Kochi (Kerala) for setting up LNG terminals for supply of 5 MMTPA of

LNG at Dahej and 2.5 MMTPA for Kochi. Work on the projects is progressing well and it is expected that the first LNG supplies to consumers would commence from Dahej in the end of December 2003. As I mentioned earlier the steel cutting ceremony of the first LNG ship, where Shipping Corporation of India is also a partner, was performed in Korea only yesterday.

I have already mentioned about the availability of various options to achieve hydrocarbon security for the country. Equity oil from abroad is also a part of the overall strategy for enhancing oil security of the country. ONGC Videsh Limited (OVL) has signed a long-term agreement with M/s Roseneft for 20% participating interest in the Sakhalin field in Russia in January 2001. The estimated investment by OVL in the field is about Rs. 8,000 Crore. Its share of oil is expected to be about 5 MMT per annum and that of gas is about 8 million cubic meters per day. The project has been already declared commercially viable is expected to go on production in 2005. In addition OVL has 45% interest in an offshore gas field in Vietnam which would go into production by December 2002.

India is keen to augment gas supplies from international sources also. To augment the gas resources, efforts are on to import piped natural gas from Iran and Bangladesh. Iran and Bangladesh have large exportable reserves of natural gas. Gas from Iran can be imported through pipeline by following an onland route or an offshore route passing through deep sea. For the onland option, security of supplies has to be ensured as investments in India will be made and would depend on the uninterrupted supply of natural gas. We want safe delivery of gas at our borders. The economic feasibility of the offshore route is also being studied to see whether it is economically competitive with LNG. Import of natural gas from Bangladesh can feed the eastern States of India. The Government has approved a consortium of three flagship national oil companies i.e. Indian Oil with 48% stake, Gas Authority of India Limited with 26% stake and Oil & Natural Gas Corporation with 26% stake for importing natural gas from Bangladesh with Indian Oil as the leader. The Government of Bangladesh is yet to take the final decision on export of natural gas to India.

I am sure that several exciting ideas would emerge during this conference. I would like to mention certain areas where the oil exporting and consuming countries can develop cooperation. One is to have regional energy security programmes in place, to ensure

adequate supplies of oil to the consuming countries in case of temporary disruptions in supplies and price volatility. The programme could perhaps involve producers setting up oil storage facilities for maintaining oil inventories in the consumer countries, the stocks to be released in emergencies resulting from disruption of supplies. Another area could be equity participation by the energy deficit countries in the upstream projects in the oil exporting countries. Now that most of the oil exporting countries are opening up their upstream sector for outside participation, such cooperation deserves consideration.

Before I close, I would like to mention that with oil sector de-regulation, immense opportunities exist in the entire chain of the oil industry from exploration and production to oil refining and marketing sectors, transportation infrastructure, etc. for companies of both Indian and foreign origin. I welcome one and all to participate.

This conference provides an ideal platform to carry out extensive and fruitful discussions and share the rich experience gained over the years in responding to supply security concerns. I thank you for the patient hearing. I once again congratulate and thank TERI for organizing this conference and for providing me an opportunity to share my views with you.

JAI HIND.

Biodata

Nirmal Singh
Senior Fellow
TERI, New Delhi

Hydro carbon areas:
Formulating policy on hydrocarbon reforms for refineries, pipelines, pricing, imports & exports of crude oil and petroleum products

Chairman of Expert Technical Group to suggest alternative mode for dismantling of Administered Pricing Mechanism and its impact on other sectors of the economy. Based on the recommendations of this Group, Government has decided to dismantle Administered Pricing Mechanism in phases.

Industrial Development:

Planning, formulating and implementing policy for the Cement Industry in the country. Coordinating for provision of infra-structural facilities for this sector and coordinating the movement of wagons, coal and other critical materials with the other concerned Ministries of Government of India and the States.

Chairman of the Group to recommend propsal for modernisation of Cement Industry. Based on the report of this Group, Govt. has approved the policy for modernisation of the Cement Industry.

Formulating policies for development of small scale industry in the country. Supervising all the Small Industry Service Institutes and other Workshops in the country. Also, responsible for Personnel Management policy of the organization. Co-ordinating with the State Govt. for the development of Small Scale Industry Sector. Formulating policy for marketing products of these sectors in the country and abroad.

Urban Development:

Responsible for formulating policy for urban development and slum improvement programmes. Also was responsible for actually implementing the policy for setting up new towns and other urban development projects.

Experience, accomplishments & training:

Seminar on Small Scale Industries, Sponsored by Asian Productivitiy Organisation. Productivity Council, Japan/Korea (1985)

Management Urban Growth Centres, Cranefield School of Management, Bedord, U.K. (1980)

Employment record:

Dates	*Employer*	*Position*
20 Oct 1975-04 May 1977		*Sub-Collector*
09 Jul 1977-01 Aug 1978	*Home Department, Govt of Tamil Nadu*	*Deputy Secretary*
02 Aug 1978-17 Jun 1981	*Madras Metropolitan Dvpt Authority (TN)*	*Chief Executive Officer*
19 Jun 1981-21 Aug 1984	*Tirunelveli District, Tamil Nadu*	*Collector & District Magistrat*
31 Aug 1984-05 Oct 1988	*Small Scale Industry, Dept of Indl Dvpt.*	*Jt Devpt Commissioner*
05 Oct 1988-30 Apr 1990	*Cement Industry, Ministry of Industry, Govt of India*	*Development Commissioner*
08 May 1990-11 Jan 1993	*Milk Prodn & Dairy Dvpt, TN Co-op Milk Producers'*	*Commissioner ; M D*
11 Jan 1993-28 Feb 1994	*Cement Corporation of Tamil Nadu, Chennai*	*Managing Director*
01 Mar 1994-01 Mar 1999	*Ministry of Petroleum & Natural Gas, Govt of India*	*Jt Secretary (Refineries)*
15 Mar 1999-09 Jul 1999	*Tamil Nadu State Electricity Board*	*Chairman*

Education

Degree	*Subject(s)*	*Year*	*Institution and place*
B A	*English,Political Science,Public Administration*	*1971*	*Punjab University*

A Profile of Shri M S Ramachandran

Shri M S Ramachandran is the Chairman of Indian Oil Corporation Ltd., the largest commercial enterprise and flagship national oil company of India. Prior to taking over as the Chief Executive of IndianOil, Shri Ramachandran was its Director (Planning & Business Development).

Shri Ramachandran leads an organisation which is India's sole representative in the prestigious Fortune 'Global 500' listing of the world's largest companies. IndianOil owns and operates seven refineries and has controlling stake in two standalone refineries. It has the country's largest network of 6523 kms crude and product pipelines, a world class R & D Centre and enjoys over 53% market share in the petroleum sales. IndianOil is now vigorously pursuing the policy of harnessing new business opportunities to maintain the market leadership even in the changed business environment.

A graduate in Mechanical Engineering, Shri Ramachandran attended Advanced Management Programmes at Ashridge Management College, United Kingdom, and Indian Institute of Management (IIM), Ahmedabad.

During his career spanning over 32 years, he has handled a variety of functions of sales, logistics, operations, commercial, shipping and international trade. As Deputy General Manager (International Trade), he played a vital role in maintaining uninterrupted supply of crude and petroleum products during the Gulf War in 1990-91, thereby safeguarding oil security of the nation. Shri Ramachandran also served as the Executive Director of Oil Coordination Committee (OCC), the then executive wing of the Ministry of Petroleum & Natural Gas, Government of India, during the critical juncture of transition of the Indian Hydrocarbon sector towards deregulation.

Shri Ramachandran's efforts as Director (Planning & Business Development) of IndianOil fructified in consolidation of IndianOil's core business activities through acquisition of downstream marketing and refining companies like IBP Co. Ltd, Chennai Petroleum Corporation Ltd. and Bongaigaon Refineries & Petrochemicals Ltd. His initiatives paved way for IndianOil gaining entry in countries like Bangladesh, Sri Lanka, Malaysia and Mauritius for marketing of petroleum products.

In addition to his assignment as Chairman, IndianOil, Shri Ramachandran is also Chairman, IBP Co. Limited and Chairman, IndianOil Tanking Ltd.

Widely travelled in India and abroad, Shri Ramachandran has participated and chaired several international Conferences, representing IndianOil and the Oil Coordination Committee (OCC).

PRESS INFORMATION – BIO PROFILE

Nigel Shaw

Chief Executive Officer

BG India Pvt Ltd

Nigel Shaw, CEO BG India is responsible for overseeing the day-to-day operations of BG India. He is also actively involved in looking at new partnerships for BG India to further the growth of its existing business interests – Gujarat Gas, Mahanagar Gas, BG E&P Put Ltd and the proposed Pipavav liquefied natural gas (LNG) importation terminal,– and also in identifying new market opportunities for the Group in India.

Prior to taking up his posting in India, Nigel Shaw was Vice President, Ireland and UK Downstream and was responsible for BG International's assets in the UK including Phoenix Natural Gas, Premier Power and Premier Transco in Northern Ireland and Seabank Power in Bristol. He was also responsible for identifying and developing energy projects in the UK and Republic of Ireland.

Nigel Shaw began his career with the Government's Economic Service in 1975. Four years later he joined BG (then named British Gas) as an Economist and worked in a number of finance and planning roles before joining the Finance department as a Financial Analyst in 1988.

In 1989 he became Group Financial Planning Manager before taking up the position of Head of Regulatory Policy for the Group in 1991. This role involved high-level dealings with the Regulator of Gas Supply and the Office of Fair Trading. He was a member of the team established to work on the 1992 referral to the Monopolies and Mergers Commission to open up the gas supply market over 25,000 therms.

In 1994 he was appointed Director of Storage within the Group's Transco business,

where he was responsible for the commercial development and growth of the gas storage business in Great Britain.

Nigel Shaw became Commercial Director of Transco in 1996 working on issues surrounding the liberalisation of the domestic supply market in Great Britain including development of the Network Code – the rules governing gas supply – pricing and investment.

In July 1999, Nigel Shaw took up his position with BG International.

Background

Nigel Shaw graduated in Economics from University College, London in 1975. A qualified accountant, he obtained a Masters in Economics from Birkbeck College, London in 1979.

He is a member of the Chartered Institute of Management Accountants.

Married with two teenage sons, Nigel lives in Rugby and enjoys golf, theatre and learning to play the piano in his spare time.

# # #

OIL & GAS SECURITY
INDIAN EXPERIENCE

THE NATURAL GAS/LNG PERSPECTIVE

Nigel Shaw, CEO

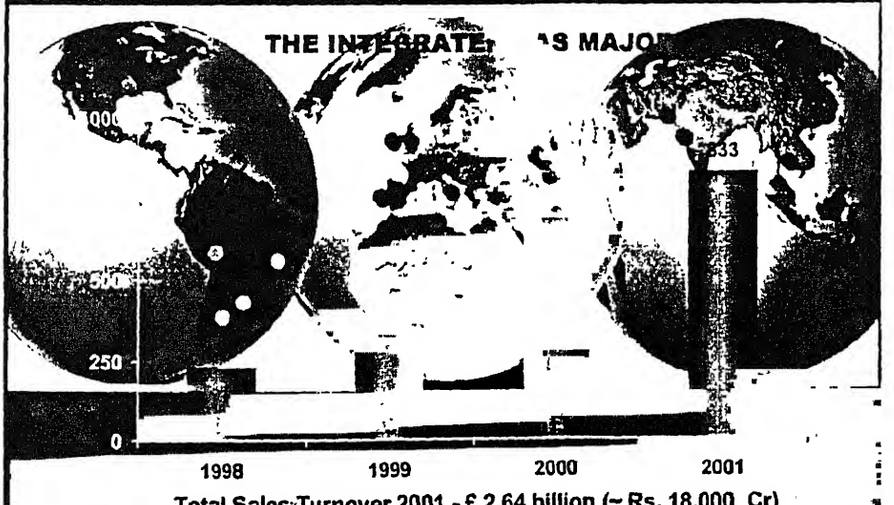
International Conference on Oil & Gas Security

May 31, 2002, New Delhi

BG Group – Presence and Performance

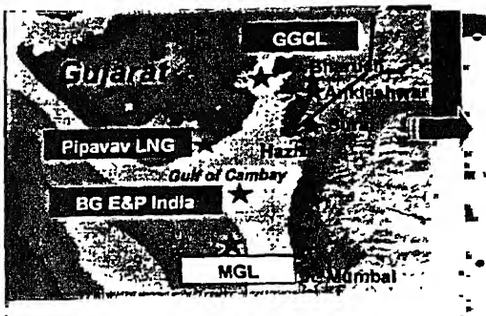
BG Group

E&P LNG Transmission Power Distribution



Total Sales Turnover 2001 - £ 2.64 billion (~ Rs. 18,000 Cr)

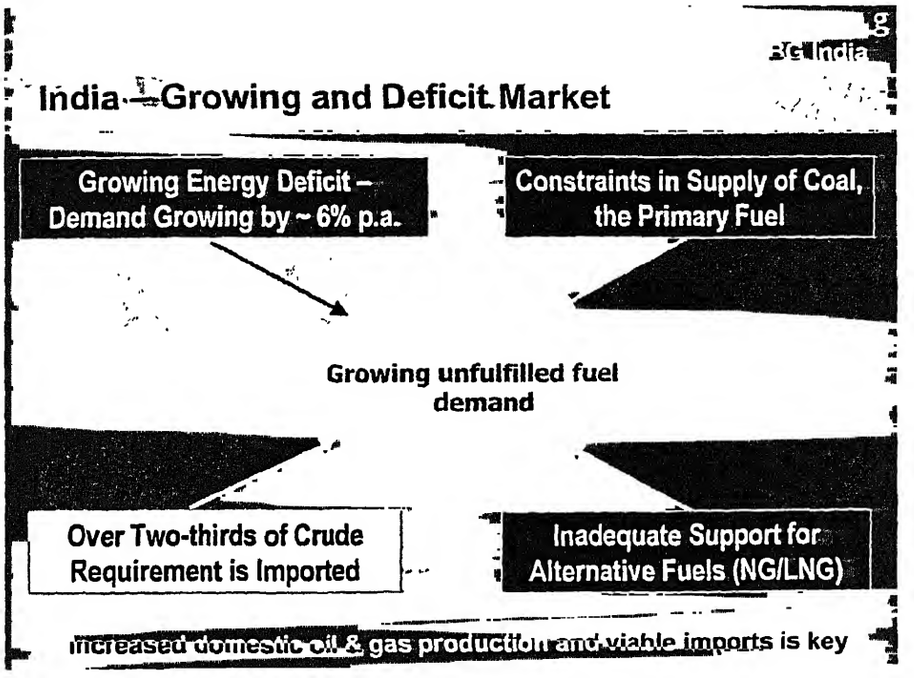
BG in India

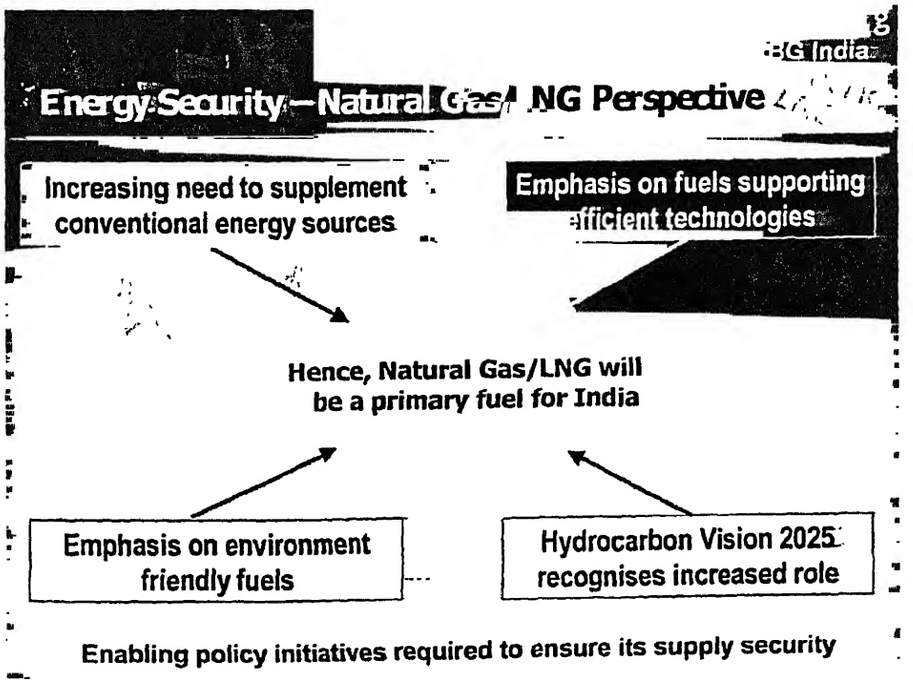


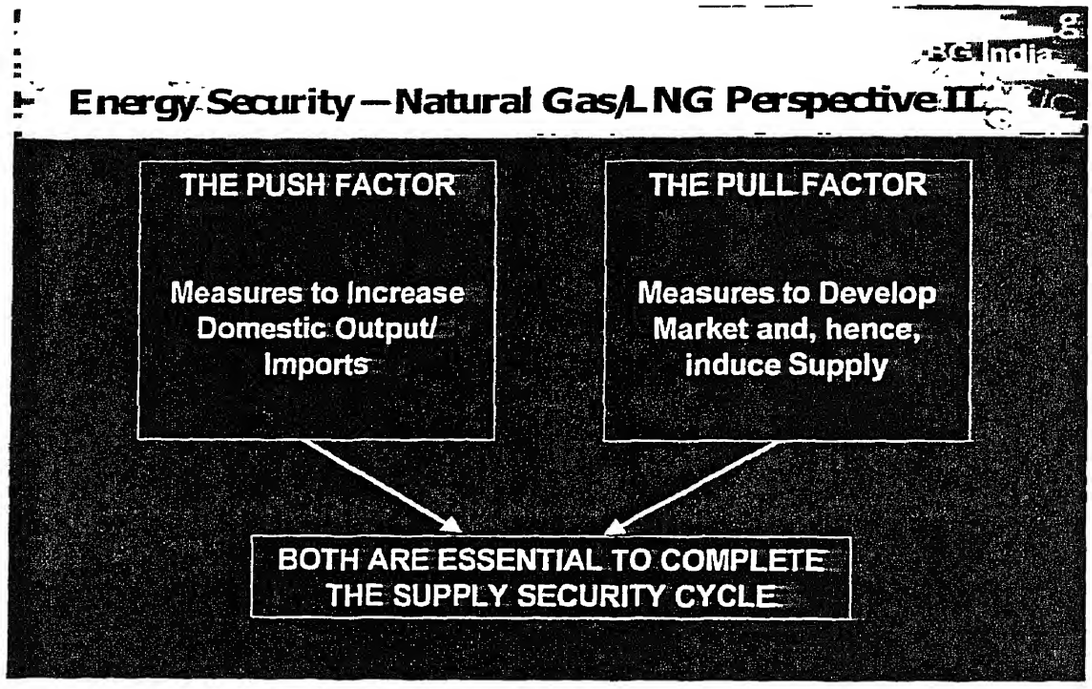
- Gujarat Gas (GGCL)
  - 65% owned subsidiary of BG
  - India's largest private distribution company
  - Significant transmission business
- Mahanagar Gas (MGL)
  - 50% joint venture with GAIL
  - Entering an era of exciting growth and possibility
  - Leading the CNG revolution in Mumbai
- BG E&P India (BGEPIL)
  - Acquired key upstream assets in West India (Panna-Mukta & Tapti and CB-OS/1)
- Developing Pipavav LNG
  - Bringing in cost-effective gas into Gujarat and neighbouring states
- Using its gas network to develop Broadband Services (Surat, Mumbai)

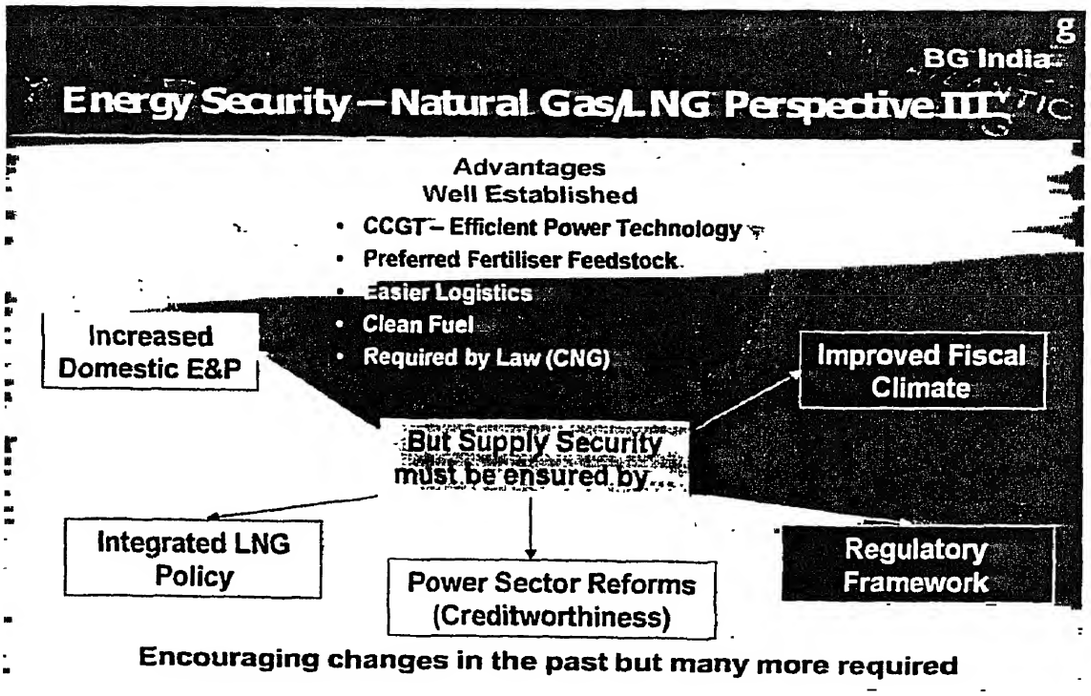
India – Policy Objectives for Energy Security

- Enhance fuel supply to match demand
- Promote optimal mix of fuels to reduce dependence on one/few
- Ensure diversity of sources for a fuel to reduce dependence on one/few

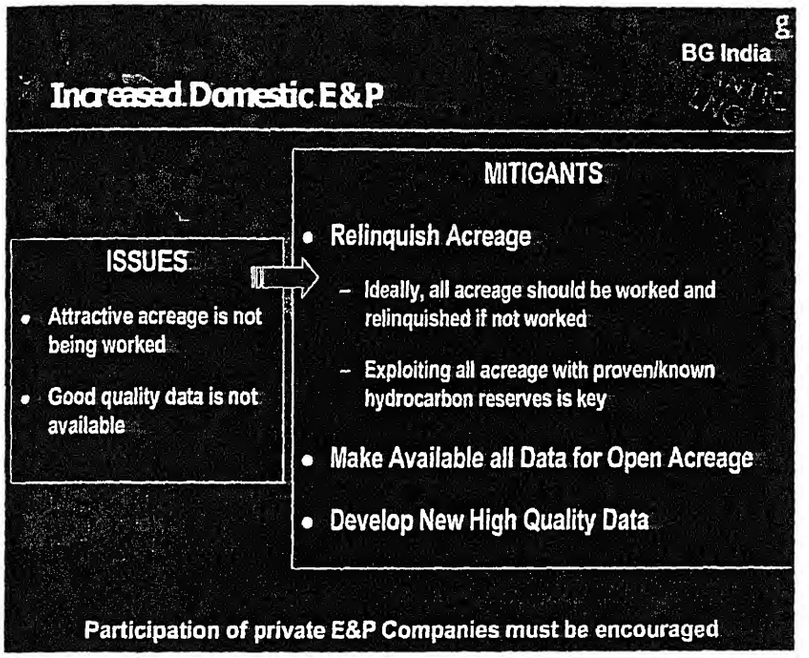

BG India
India – Growing and Deficit Market
Growing Energy Deficit – Demand Growing by ~ 6% p.a.
Constraints in Supply of Coal, the Primary Fuel
Growing unfulfilled fuel demand
Over Two-thirds of Crude Requirement is Imported
Inadequate Support for Alternative Fuels (NG/LNG)
Increased domestic oil & gas production and viable imports is key

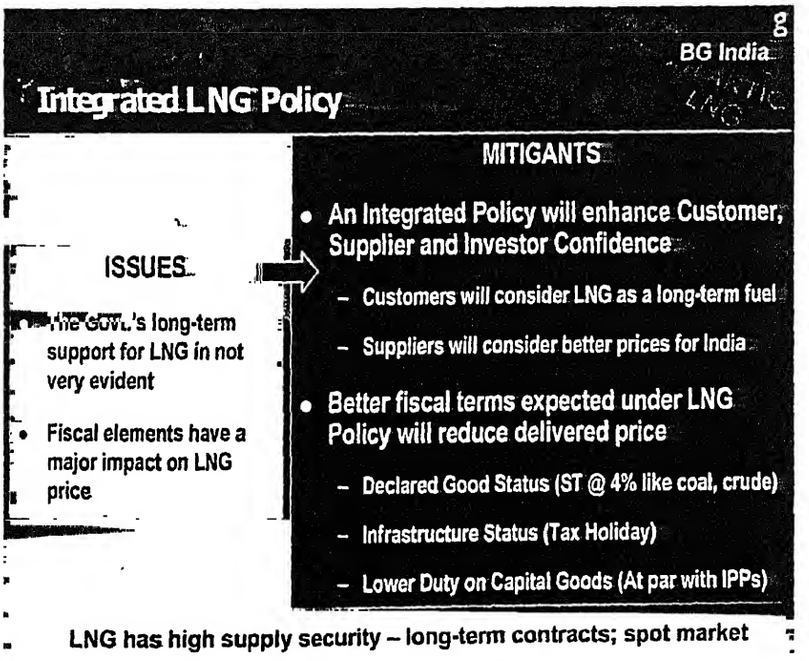

BG India
Energy Security – Natural Gas/LNG Perspective
Increasing need to supplement conventional energy sources
Emphasis on fuels supporting efficient technologies
Hence, Natural Gas/LNG will be a primary fuel for India
Emphasis on environment friendly fuels
Hydrocarbon Vision 2025 recognises increased role
Enabling policy initiatives required to ensure its supply security





Encouraging changes in the past but many more required


BG India
Increased Domestic E&P
ISSUES
• Attractive acreage is not being worked
• Good quality data is not available
MITIGANTS
• Relinquish Acreage
– Ideally, all acreage should be worked and relinquished if not worked
– Exploiting all acreage with proven/known hydrocarbon reserves is key
• Make Available all Data for Open Acreage
• Develop New High Quality Data
Participation of private E&P Companies must be encouraged


BG India
Integrated LNG Policy
ISSUES
• The GOI's long-term support for LNG in not very evident
• Fiscal elements have a major impact on LNG price
MITIGANTS
• An Integrated Policy will enhance Customer, Supplier and Investor Confidence
– Customers will consider LNG as a long-term fuel
– Suppliers will consider better prices for India
• Better fiscal terms expected under LNG Policy will reduce delivered price
– Declared Good Status (ST @ 4% like coal, crude)
– Infrastructure Status (Tax Holiday)
– Lower Duty on Capital Goods (At par with IPPs)
LNG has high supply security – long-term contracts; spot market

Improved Fiscal Climate

BG India

ATLANTIC LNG

ISSUES

- Sales Tax on Natural Gas is too high (15-22%)
- There is uncertainty over the treatment of Natural Gas in the imminent VAT regime

MITIGANTS

- Key consuming states like Gujarat & Maharashtra must rationalise Sales Tax
  - Lower rates will enhance usage
  - Enhanced volumes will maintain/enhance revenue
- Natural Gas/LNG must be included in the VAT regime
  - Input Tax Credit must be available to customers
  - Being an industrial input into priority sectors, must be classified in the 4% category

The existing fiscal anomaly (high taxes and then subsidies) must be corrected

Appropriate Regulatory Framework

BG India

ATLANTIC LNG

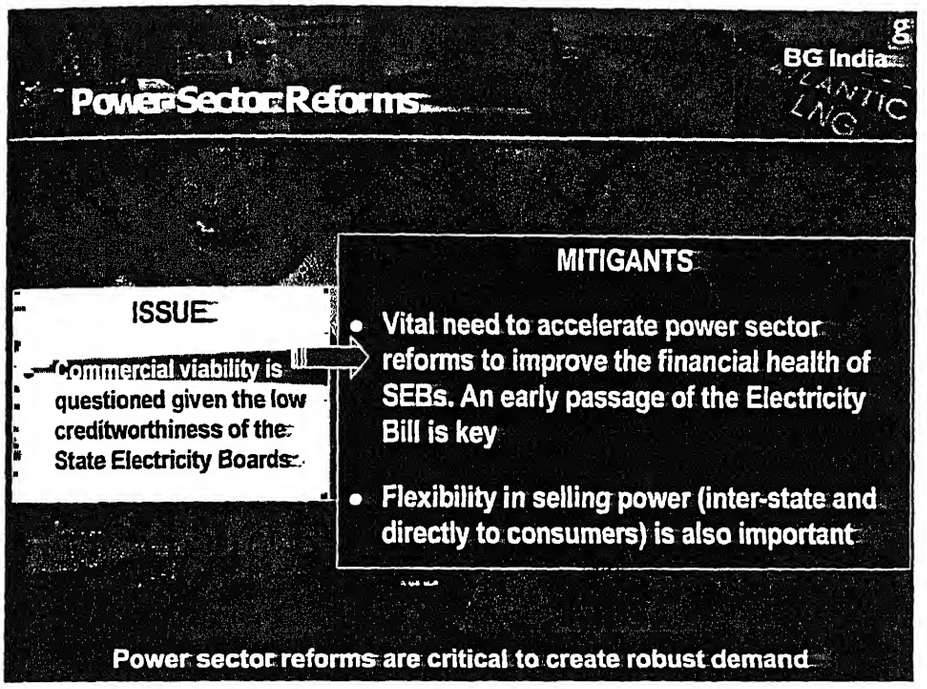
ISSUES

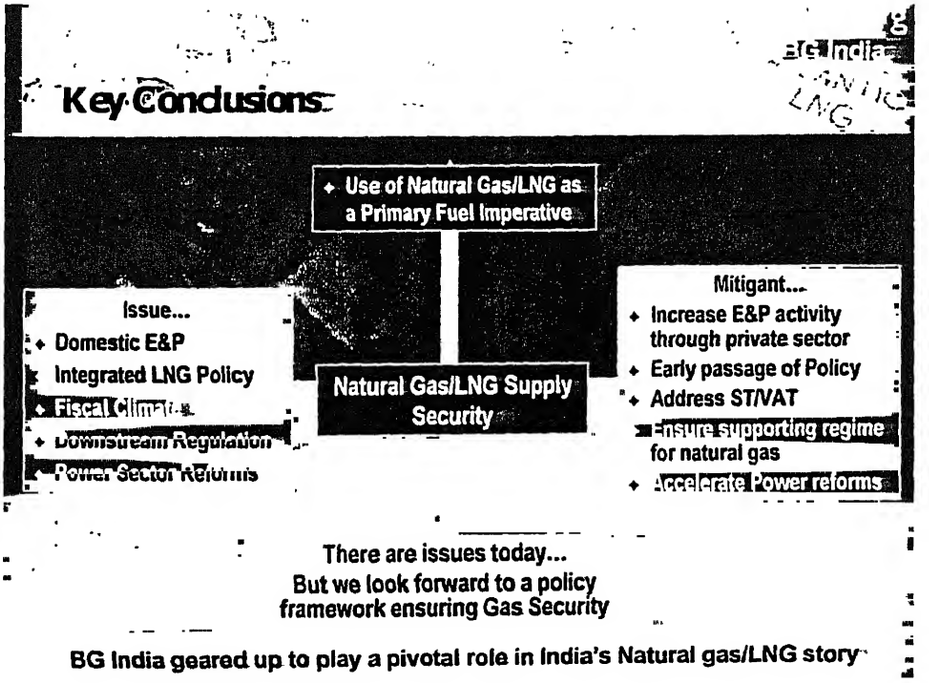
- The rules for gas transmission, distribution and supply are not clearly established
- There is insufficient transmission infrastructure. Access to key existing pipelines may not be easy

MITIGANTS

- Imminent Federal Regulation must
  - Ensure an investment encouraging framework for the nascent natural gas industry
  - Clearly address third party access and right to build new pipelines
  - Minimise regulatory risk for new investors
  - Promote an interconnected gas grid
- Regulation must evolve appropriately as the industry develops

A well-developed and clear system for bringing gas to market is key


BG India
Power Sector Reforms
ISSUE
Commercial viability is questioned given the low creditworthiness of the State Electricity Boards
MITIGANTS
Vital need to accelerate power sector reforms to improve the financial health of SEBs. An early passage of the Electricity Bill is key
Flexibility in selling power (inter-state and directly to consumers) is also important
Power sector reforms are critical to create robust demand


Key Conclusions
Use of Natural Gas/LNG as a Primary Fuel Imperative
Issue...
Domestic E&P
Integrated LNG Policy
Fiscal Climate
Downstream Regulation
Power Sector Reforms
Natural Gas/LNG Supply Security
Mitigant...
Increase E&P activity through private sector
Early passage of Policy
Address ST/VAT
Ensure supporting regime for natural gas
Accelerate Power reforms
There are issues today...
But we look forward to a policy framework ensuring Gas Security
BG India geared up to play a pivotal role in India's Natural gas/LNG story

Mr Rajendra Prashad is a Chemical Engineer from IIT Delhi and with post-graduation from IIT Bombay. Presently, he is working as Senior Manager with M/s Engineers India Ltd, New Delhi and has more than 26 years experience in Process Design & Development Division, Plant Operation & Safety Department, Research & Development Division and Petrochemical Project Services Department of the company. He has experience, both in design and field work, covering petrochemicals, gas processing, pipelines and refineries. At present he is engaged in jobs related to risk analysis, safety audit, HAZOP studies, design of offsite storage, pre-commissioning and commissioning assistance. Some of the major projects handled by him include naphtha and gas based ethylene plants, refinery units, gas sweetening, gas processing and LPG plants. He provided services as project management consultant for Petronas, Malaysia for their VCM project which is world biggest single train VCM plant.

Mr Prashad was sponsored for study at University of Massachusetts, Amherst under UNDP fellowship. He has widely traveled for interaction with various technology licensors. He was a member of research team for development of acrylate technology based on which plant was set up at IPCL, Vadodara and had also been involved in development of process simulation software which were used in design of refinery units in early eighties.

Mr Prashad is a philatelist and has won medals in several national and international philatelic exhibitions. He represented India as Assistant Commissioner at International Philatelic Exhibition held at Taiwan in 1996.

CRUDE STORAGE PHILOSOPHY TO MEET CRISIS SITUATION

In view of dependence on crude oil import from Middle East, security of supply of petroleum products becomes on important issue and it is necessary to build strategic storage for crude oil. Technology for strategic storage is different from that used for conventional storage system. Technological issues related to the subject shall be addressed in this presentation

Conventionally, floating roof type above ground steel tanks are employed for storage of crude oil which have several limitations.

For strategic storage of crude oil and other petroleum products, underground storage systems are deployed. These could be:

- Depleted oil or natural gas fields
- Aquifer storage
- Salt caverns
- Underground concrete tanks
- Underground rock caverns

Depleted oil or natural gas fields, aquifer storage and salt caverns are widely used in USA and Canada. However, for India underground concrete tanks and underground rock caverns are suitable solutions for strategic storage of crude oil.

Size of underground concrete tanks can be between 0.5 to 1 million cubic meters and size of underground rock caverns can be as high as 10 million cubic meters. For building a rock cavern, main factors to be taken into account are:

- The bedrock must be sufficiently hard and homogenous
- Rock caverns must be excavated below the groundwater level to a depth where the groundwater pressure around the cavern is higher than the pressure inside the cavern

Such conditions are available in coastal areas. Hence, underground concrete tanks are suitable option for inland locations in India whereas underground rock caverns are suitable for coastal areas.

Paper presented by Rajendra Prashad, Engineers India Ltd, New Delhi

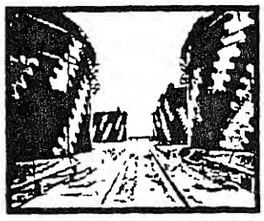
CRUDE STORAGE PHILOSOPHY TO MEET CRISIS SITUATION

NECESSITY OF STRATEGIC STORAGE

- Dependence on crude oil import
- Major source of import is Middle East
- Import through sea route only
- Possible disruption in supply due to blockage of sea route
- Disruption in supply due to war situation

LIMITATIONS OF ABOVE GROUND STORAGE

- Maximum capacity in a dyke limited to 120,000 M^3
- Height of tank is restricted
  - Bearing capacity of ground
  - Prevailing wind load
- Large land requirement
- High cost of construction
- Limited safety from external attacks



UNDERGROUND STORAGE SYSTEMS

- Depleted natural gas or oil fields
- Aquifer storage
- Underground salt caverns
- Underground concrete tanks
- Underground rock caverns

DEPLETED OIL OR NATURAL GAS FIELDS

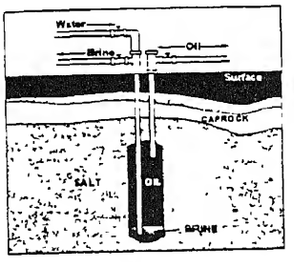
- Mainly used for gas storage
- Suitability depends on
  - Porosity
  - Permeability
  - Retention charactenstics
- Economical as existing setup can be used
- Used first in Ontano in 1915
- Gas is being stored in 400 such fields worldwide

AQUIFER STORAGE

- Conditioned water only reservoir
- Good for storage of gaseous products
- Used when depleted oil or gas reserves are not available
- Possibility of contamination of water supplies
- In USA, located in States of Illinois, Indiana and Iowa

UNDERGROUND SALT CAVERNS

- Prepared by injecting water in salt formations
- Petroleum products replace brine
- Withdrawal by pumping in brine



EIL NEW DELHI INDIA

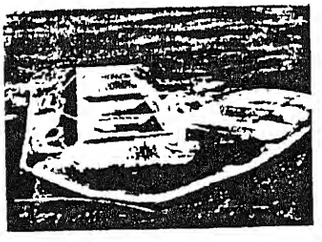
UNDERGROUND SALT CAVERNS

- Salt cavern is virtually impermeable to gas
- More than 100 salt caverns are in use in USA & Canada for storage of NGL
- The Strategic Petroleum Reserve has four sites in Texas and Louisiana Gulf Coast for emergency storage of crude oil

EIL NEW DELHI INDIA

UNDERGROUND CONCRETE TANKS

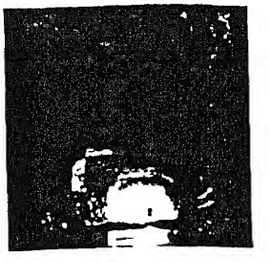
- Size can be about 1,000,000 M^3
- Constructed by monolithic reinforced concrete
- Internally coated to reduce crude oil permeability
- HDPE external membrane for pollution control



EIL NEW DELHI INDIA

UNDERGROUND ROCK CAVERNS

- Shaped like horizontal tunnels
- Tunnel height is about 25 to 30 M
- These are generally unlined
- For liquid storage could be 10,000,000 M^3



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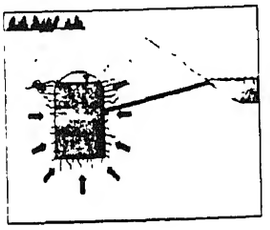
UNDERGROUND ROCK CAVERNS

- Principle of storage
  - Specific gravity of oil is less than that of water
  - Oil is insoluble in water
  - Pressure of water on cavern walls is more than pressure of oil in cavern
  - Water continuously seeps into cavern
  - Oil is always floating on a layer of water



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UNDERGROUND ROCK CAVERNS

- Can be developed by excavation of rocks
- Hard intact rock with low permeability is required
- Preferred rock types.
  - Granite
  - Gnesses
  - Basalt
  - Limestone
- High water table preferred

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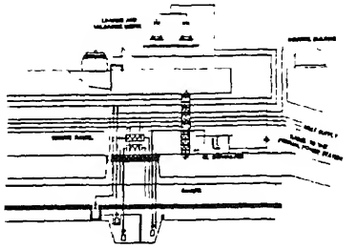
UNDERGROUND ROCK CAVERNS



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ADVANTAGES OF UNDERGROUND ROCK CAVERN STORAGE

- Corrosion problems are eliminated
- Operation and maintenance costs are lower
- Nitrogen blanketing is not required
- Product evaporation losses are reduced due to lower & uniform temperature and possibility of storing under pressure
- Since very small part of the facility is above ground, the land costs are low

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ADVANTAGES OF UNDERGROUND ROCK CAVERN STORAGE

- Environmentally safe
  - Risk of leakage are minimal
  - Entire storage cavern is practically invisible and the landscape above ground remains untouched and is free for other purposes
- Safe and secure
  - Risk of fire and explosions are low and the cavern can withstand internal explosion
  - Secure against sabotage and acts of war

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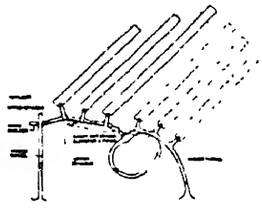
ADVANTAGES OF UNDERGROUND ROCK CAVERN STORAGE

- Design freedom
  - Freedom with respect to geometrical form, size, direction etc
- Ease of expansion
  - Access tunnels of old caverns can be used for construction of new caverns



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STRATEGIC STORAGE SOLUTION FOR INDIA

- Underground concrete tanks
  - Suitable for inland locations
  - Size can be 0 5 to 1 million cubic meters
  - May not be viable in coastal areas
- Underground rock caverns
  - Viable in coastal areas due to availability of required water table
  - At coastal area oil shipment is easy
  - Size can be above 1 million cubic meters
  - May not be viable at inland location

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UNDERGROUND ROCK CAVERN STORAGE

POLICY MATTERS

- Agency to invest and maintain the storage
- Agency for deciding policy for distribution
- When the storage shall be used, during supply blockage or for price manipulation
- Quantity to be stored and locations
- Building distribution network
- Basis of pricing or to supply against replenishment

EIL NEW DELHI INDIA

Brief C.V. of Dr. Sanjiv Misra

Dr. Sanjiv Misra, IAS, is currently a Joint Secretary in the Cabinet Secretariat. He has earlier worked as a Joint Secretary in the Ministry of Petroleum and his Ph.D thesis is on the `Political Economy of International Oil'. His academic background is in Economics and he has lectured in the subject at Delhi University. He also has a Master's Degree in Public Administration from the John. F. Kennedy School of Government, Harvard University, where he was designated Littauer Fellow of 1987 in recognition of outstanding merit. He has also been a Senior Fellow at the Centre for Policy Research, New Delhi.

International Conference on Oil and Gas Security

31st May – 1st June 2002

OIL SECURITY – AN INTERNATIONAL REGIME PERSPECTIVE

By

Dr. SANJIV MISRA, IAS.

I. ROOTS OF OIL INSECURITY

- During the last 30 years or so, oil prices have exhibited considerable volatility and instability.
- This is partly on account of the fact that around 65% of the world's recoverable oil resources are concentrated in one region, namely, the Middle East, which is also politically unstable.
- This has contributed to the phenomenon of `oil shocks'. In fact there have so far been six major oil supply disruptions which have affected world crude oil supplies by more than two million barrels per day and all of these have emanated from the Middle East.
- Cartelisation of crude oil production has also contributed to instability. OPEC presently controls over 35% of world oil supplies and it is estimated that its share in the world production of oil could rise to 50% by the end of the next decade.

II. ARE OIL PRICES INHERENTLY UNSTABLE ?

- The economic argument · Volatility is inherent in crude oil prices on account of the nature of the supply and demand responses to changes in economic parameters
- Being necessary goods, petroleum products have a low price elasticity of demand in the short run due to the relative absence of substitution possibilities. Demand is affected primarily through 'income effects' - impact on purchasing power and economic growth.
- Similarly, the supply of crude oil is inelastic to price changes in the short run, given the nature of the production process. Supply response is, therefore, entirely contingent on the existence of `spare capacity' in the main producing countries. Consequently, during periods of low spare production capacity, even a small reduction in supply can lead to large price increases and spurt in speculative demand for petroleum projects.

- So far, only Saudi Arabia has had any significant spare oil production capacity. Thus Saudi Arabian production behavior has been a crucial element in oil price stabilisation.
- Oil price volatility can, to a large extent, be regarded as a consequence of `market failure' arising out of :
  - Incomplete/incorrect information regarding demand and supply patterns and responses.
  - Uncertainty regarding cartel behavior.
- This is compounded on account of the uncertainty resulting from the political situation in the Middle East.
- Both these factors contribute to the problem of oil insecurity.

III. TYPICAL RESPONSES

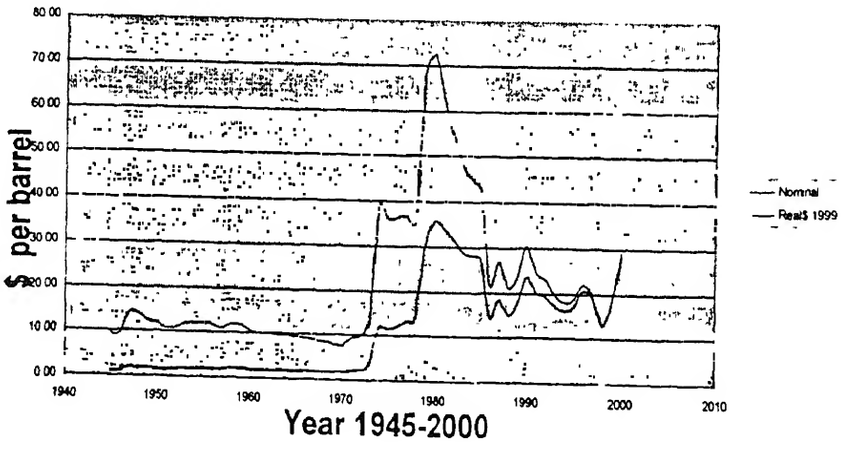
- Oil security has been viewed largely as a national problem. Each affected nation has tried to devise strategies best suited to its perceived national interest.
- Attempts at cooperation among the major oil consuming nations forged in the wake of the oil crisis of the 1970s, in the form of the IEA have not been very effective.
- At the international level, the focus of the major consumers has been towards forging individual strategies such as the `special relationship' between the US and Saudi Arabia and other Gulf countries. Other major oil consuming nations of Europe (especially France) and of Asia, such as Japan have also devised their own strategies.
- Individualised national strategies at the domestic level, such as the creation of a Strategic Oil Reserve (SOR) are usually an extremely expensive proposition for a developing country like India. According to a TERI estimate, the cost of SOR covering three months import requirements would be around Rs.40,000 crores., exclusive of maintenance and recurring costs.

- Energy security has been a major concern of India's foreign policy. In fact India's foreign policy options have been significantly constrained on account of this.

IV. LESSONS FROM THE PAST

- Price volatility has been a significant characteristic of the international oil system only since the 1970s. In fact, there was a remarkable stability in international oil prices for almost four decades during the period 1930 to 1970. The following graph covering the period 1945 - 2000 clearly highlights the extraordinary price stability that prevailed up to the early 1970s

Crude oil price trend



IV. LESSONS FROM THE PAST Continued...

- During this period there existed an international oil regime involving the major oil multinationals, often referred to as the 'seven sisters'. The regime was characterised by elaborate intermeshing arrangements among the oil majors regarding the production, processing, marketing as well as the pricing of oil.
- The regime was an offshoot of colonial power and involved the dominance of the large vertically integrated multinational oil companies. Its distributive aspects, in terms of the gains and benefits to the producing countries were seriously questioned, bringing about the ultimate collapse of the regime.
- Nevertheless, the important historical lesson to be learnt from this experience is that the volatility of oil prices can be greatly reduced by appropriate institutional arrangements at the international level.

V. NEED FOR AN INTERNATIONAL OIL REGIME

- Individualised national responses, apart from being extremely costly, do not tackle the root of the problem which basically arises out of lack of reliable information regarding producer behavior (further complicated by OPEC) and political uncertainty.
- This is a classical game theory situation where each player assumes the worst possible scenario and acts accordingly. This often results in zero or negative sum outcomes.
- Game theory itself indicates that in situations of complex inter-dependence, the unfettered pursuit of self-interest can result in sub-optimal outcomes. Co-operation would be beneficial to all players.
- There is presently no international institutional mechanism representing both producing and consuming nations. The establishment of such an institutional framework is a sine qua non for promoting greater stability of prices and supplies in the international oil system.

- The establishment of such a framework could .
  - Facilitate coordinated policy responses relating to production and consumption of petroleum.
  - Facilitate greater transparency in the flow of information between producing and consuming nations relating to demand and supply patterns and responses; and
  - Permit a more intensive dialogue on the political dimensions of international oil transactions.
  - Facilitate a more rational management of a critical, non-renewable energy resource.
- Such a process could considerably reduce the uncertainties both economic as well as political relating to the international oil system which are the underlying source of price volatility and oil insecurity.

VI. POSSIBLE CRITIQUE OF THIS APPROACH

- The main criticism of such an approach could be :
  - It is utopian and ignores the `realpolitik' of international relations; and
  - There is little incentive for OPEC, particularly Saudi Arabia, which is the main beneficiary of the existing dispensation to be a part of such a regime.
  - The U.S. has traditionally been very wary of any international institutional mechanism concerning oil. It has preferred the freedom of action of an individual strategy tailored to its own strategic interests.
- In response it can be argued that :
  - Oil price stability is desired by both the consuming and the producing nations. Very high or very low prices are not in the long-term interests of either producers or consumers. Neither is price volatility.

- Among the stated objectives of OPEC itself is the maintenance of prices within a specified band. Historical experience has clearly shown that in such cartels, production discipline is virtually impossible to enforce for any length of time.
- With so many unknown parameters in the equation, such fine tuning of prices has simply not been possible. In fact cartel behavior itself has contributed to the volatility of prices.
- Most of the OPEC producers are strapped for cash and would prefer a stable demand in a growing world economy which would provide them with the requisite revenue stability.
- The emergence of Russia as a significant oil exporter and the likely development of substantial production capacities in the Caspian Sea and Central Asia pose very tangible threats to the continued dominance of OPEC in the future

- Post September 11, and given the current situation in the Middle East, the `special relationship' between the US and Saudi Arabia, the main pillar of stability in the present international petroleum order, has come under considerable strain.
- In the context of the changed circumstances and given the growing dependence of the U.S. on Middle Eastern oil, the close relationship with the Gulf countries cannot indefinitely remain the main plank of U.S oil security in the future.

VII. CONCLUSION

- The present environment is conducive for concerted diplomatic initiatives for evolving an international institutional mechanism comprising both producers and consumers of oil in the interests of greater economic stability, world prosperity and oil security.
- As a major oil consuming country of the developing world, India should take initiative in evolving an international consensus in this regard.
- This can at best be a medium term goal and does not preclude the immediate measures required at the national level to provide adequate energy security to the country.

Thank You

Brief bio-data of Mr S K Sharma
Executive Director, Bharat Petroleum Corporation

Mr. Sharma completed his M.Tech in Industrial Engineering from IIT, Delhi in 1975. Currently, he is Executive Director in Bharat Petroleum Corporation and heads the Department of International Trade & Supplies. Under his stewardship for last four years, the International Trade & Supplies Department in BPCL is smoothly sailing through the period of deregulation and integration with global oil industry. Mr. Sharma has held a number of key positions in Marketing and Engineering functions in BPCL. He is member of a number of Committees in Indian Oil Industry and has represented BPCL in many overseas forums.

Oil & Gas Security
International Experience

Presented by
S.K. Sharma
Executive Director
International Trade & Supplies
Bharat Petroleum Corporation Ltd

Highlights

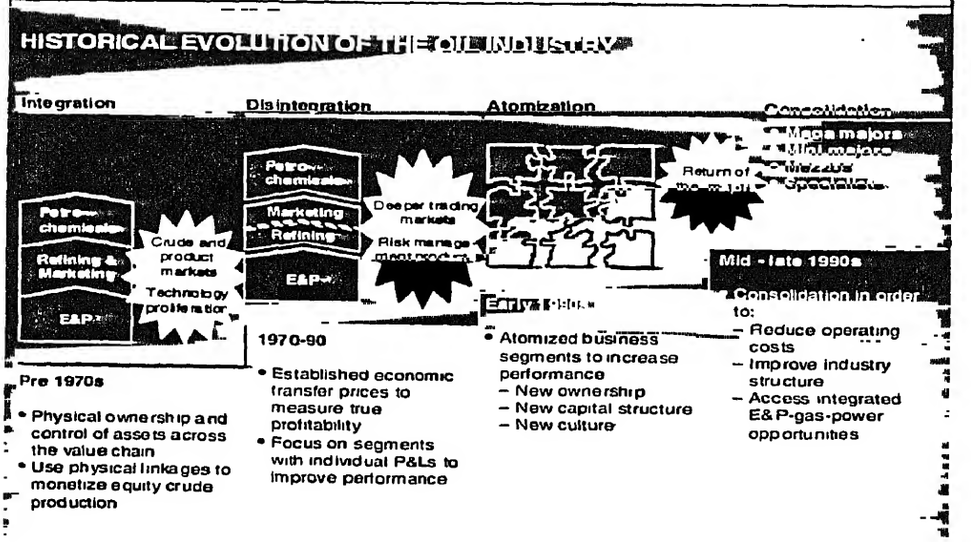
- Perspective of Hydrocarbon sector and Security
- Drivers for Oil and Gas Security
- Major Players
- Trade & Mechanics of the Business

Security is to be viewed and to be maintained as a Business Process and a strategic issue

Structure & Content

Structure	Content
World Trade Flow	• Conventional • Emerging
International Experience	• JAPAN • USA
Indian Context	• Demand side • Supply side • Others

Historical Evolution of Oil Industry



World oil Reserves

bp

oil

Proved reserves at end 2000

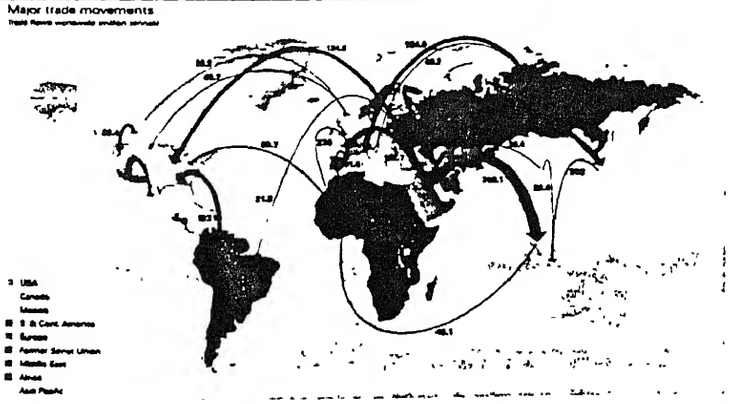
bp statistical review of world energy 2001

World oil trade flow
Conventional

bp

oil

Major trade movements



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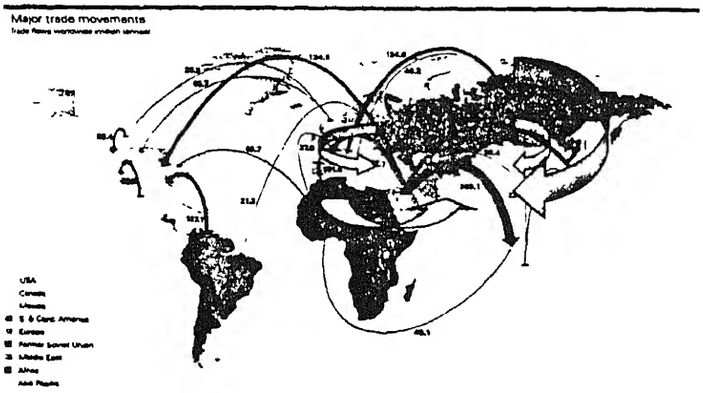
World oil trade flow Emerging

bp

oil



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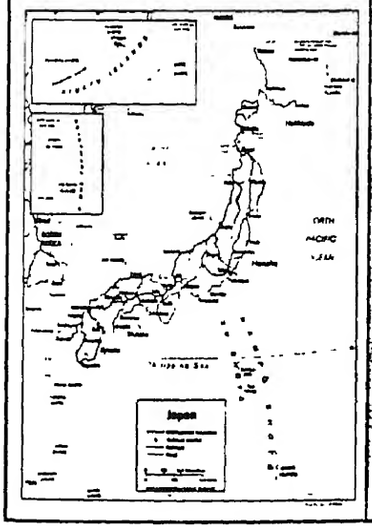
Drivers of Oil & Gas Security

- **Balanced Supply Chain**
- **Volatility in Prices**
- **National Security**
- **Substitution in Energy**
- **Environmental Protection**

Major Players in Oil & Gas Sector

- Producers / Equity Holders
- Oil Majors
- Traders
- Bankers
- Oil Exchanges
- Shipping Companies
- Refining and Marketing Companies
- National Oil Companies

Japan Profile in Oil & Gas Sector



Japan's oil reserve is nil

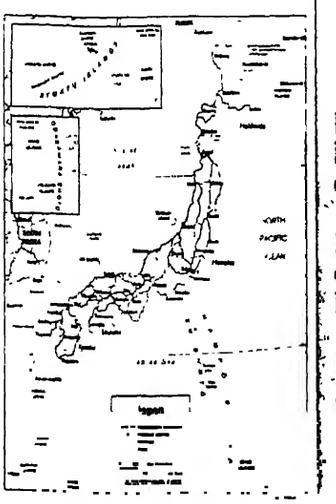
Hundred percent import dependent
87% of oil requirement from ME

1990-2000: GDP growth 1.3%
Energy demand growth 1.5%

Growth in supply of Oil : nil
Nuclear power : 4.3%
Natural Gas : 4.1%
Coal : 2.2%

Oil's share in total energy supply
1973 : 78%
1990 : 58%
2000 : 52%

Japan
Profile in Oil & Gas Sector



- Liberalization of Japan's oil industry is complete with lifting of Govt. control in 1996
- 20 oil refining & distribution companies have been reorganized into 4 groups
- Refining capacity declined from 5.5 mbd in 1999 to 5 mbd in 2001

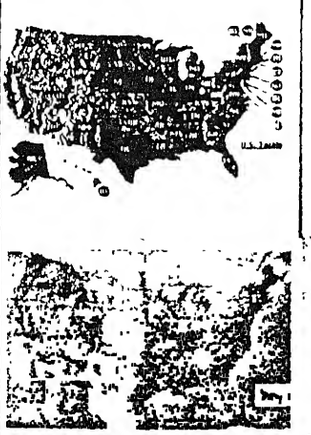
Japan's
Oil security Measures

- Maintaining and enhancing emergency response measure.
- Maintaining and enhancing friendly relations with Middle East countries and other energy producing countries.
- Promoting energy conservation, efficient use of energy and alternate energy.
- Development of 'Japanese flag crude oil'.
- Response to environmental issues

USA
Profile in Oil & Gas Sector

- 22 bl. Bbl of oil reserves - 12th highest
- 2001 - produced 8.1 mbd (5.9 mbd Crude)
- consumed 19.6 mbd (44% gasoline)
- Imported 11.6 mbd (Crude & product)
  - ≈ 59% of total US oil demand
- OPEC's share in import : 47%
- ME source : 23%

USA
Profile in Oil & Gas Sector



- Top suppliers : Canada (1.8 mbd)
  - Saudi (1.7 mbd)
  - Venezuela (1.5 mbd)
  - Mexico (1.4 mbd)
- Oil's share in energy production : 22 %
- Natural Gas share - 27%
- Decline in Refining capacity : 3 mbd (81 - 89)

USA's Oil security measures
Policy & Goal

Comprehensive National Energy Strategy
(April 1998, revised May 2001)

Goal II → **Protecting economy from external threat of interrupted supplies or infrastructure failure**

USA's Oil security measures
Objectives

Reduce the vulnerability of the US economy to disruptions in oil supply

Ensure energy system reliability, flexibility and emergency response capability

USA's Oil security measures
Strategies : Objective 1

Reduce vulnerability of US economy to disruption in Oil supply

- By 2005, stop the decline in domestic oil production
- Maintain readiness to address threat and disruptions to world oil supplies
- Diversify sources of oil available in world oil market
- By 2010, develop technology options to help reduce expected oil consumption by at least 1 mbd.

USA's Oil security measures
Strategies : Objective 2

Ensure energy system reliability, flexibility and emergency response capability

- Promote the reliability and flexibility of electricity generation, transmission and distribution.
- Promote the reliability and flexibility of domestic oil refining, transportation and storage.
- Promote the reliability and flexibility of natural gas transportation and storage.

USA's Oil security measures
Next Oil Frontier

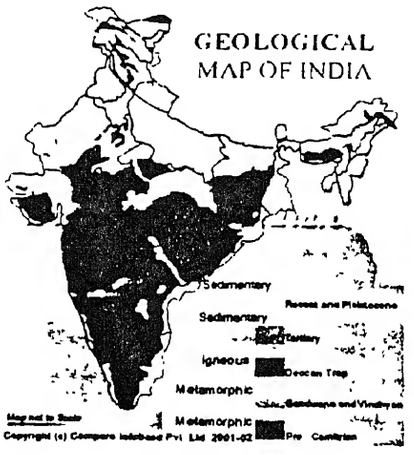
19

American Soldiers, Oil Companies and Diplomats are carving out a new Sphere of Influence on Russian Boarders

- **US investment in Caspian Basin region has jumped to 20 billion $.**
- **4000 soldiers are building bases, assisting the Afghan war and training anti insurgency troops.**
- **Energy majors, viz., ChevronTexaco, ExxonMobil, BP and Halliburton are investing in exploration, production and infrastructure.**
- **US Govt. aid to the region, including program to improve irrigation, battle drug traffickers and train software programmers is to jump 50% from pre Sept. 11 levels to 809 million $ a year.**

Oil Security
Indian Context

20



Security Exposure

70 MMT of Product

or

84 MMT of Crude

(which ever is lower)

Oil Security Measures
Demand side

- Conservation in use of Oil
- Commercial exploitation of non-fossil renewable energy
- Availability and rational use of alternate form of energy

Oil Security Measures
Supply side

- Source - diversify; newly developed fields, diplomatic and commercial activities
- Shipping - VLCC handling
- Storage - Augment storage, floating storage, Strategic storage shared with regional blocks like SAARC and ASEAN countries

Oil Security Measures
Others

- A strong and vibrant economy, large foreign exchange reserve, large export earning, large share in international trade
- Attractive investment environment and fiscal system for foreign capital to be used in exploration and production
- acquire equity in overseas oil fields
- Trading in physical and paper Oil

Recommendations

- Indian flag crude oil
- Off- shore refining capacity
- Strategic storage location
  East Coast & West Coast (floating storage)
- P/L & associated infrastructure.
  National grid for product & crude.
- National Oil Company's role
- Diplomatic and Political measures
- Shipping & Logistics channels
- Active participation of Indian companies in Oil trading
- Active Risk Management measures

Brief CV of Shri I L Budhiraja

After graduating from Indian School of Mines, Dhanbad in 1961, Shri Budhiraja pursued Post Graduate studies at the University of Alberta, Edmonton, Canada, from where he earned an M.S degree in Petroleum Engineering in 1963.

Immediately after graduation he joined Shell Canada, where he was mostly involved in Research work connected with the development of Heavy Oil deposits of Athabasca in North Alberta and production of reservoir fluids rich in sulphur and H_2S.

After returning to India he took up a job with ONGC, where he worked in various capacities.

In 1990 he was appointed to the Board of Directors of Gas Authority of India Ltd., where he worked till 1996.

He has been closely involved into the design of Oman India Deepwater Pipeline. His last job with Govt. was as Coordinator of National Gas Hydrate Programme.

He joined Reliance in 1998, and has been heading Reliance's Oil & Gas Division since then.

Presentation on

Oil & Gas Security
&
International Experience

I L Budhiraja

Reliance Industries Limited

31st May – 1st June ' 2002

NEW DELHI

Oil & Gas Security - In The Indian Context

ULTIMATE SECURITY LIES IN SELF SUFFICIENCY

Example is Food Security – An Ultimate Indian Success Story

Fifties and Sixties : PL 480 - Ship to Mouth Situation

Situation Today : 60 Million , Tonnes of Food Glut

This has been the result of an Integrated Food Development Programme
- Irrigation, Research, Fertilizer, Block Development

Can this be replicated in the Energy Sector ?

Oil & Gas Security - In The Indian Context

INDIA NEEDS TO ATTAIN SELF SUFFICIENCY IN ENERGY

CONVENTIONAL PETROLEUM EXPL. & DEVELOPMENT : OIL

- Develop Unexplored Acerage especially in Deep Waters
- Develop Extensive System Of Pipelines & Strategic Reserves

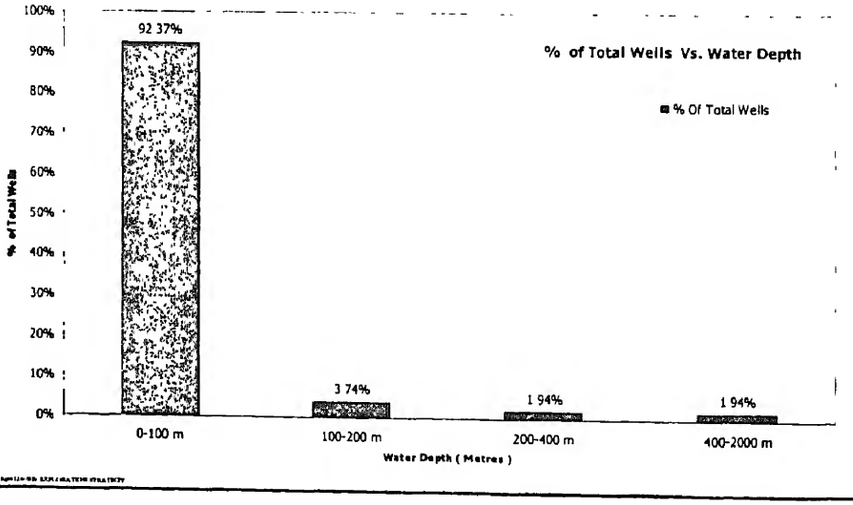
GAS

- Natural Gas
- Coal Bed Methane
- Gas Hydrates
- In Situ Combustion

INTERNATIONAL GAS HYDRATE PROGRAMME
US / Canada / Japan

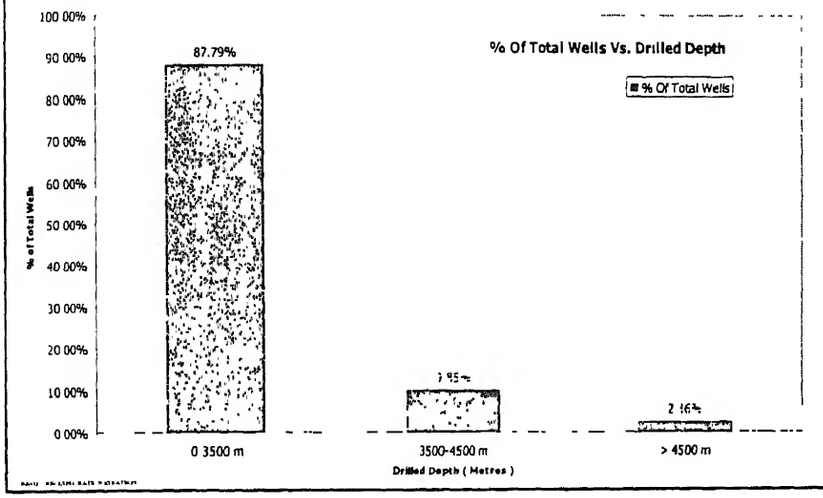
Conventional Petroleum Expl. & Dev. (OIL)

What have we been doing until now in terms of water depth ?



Conventional Petroleum Expl. & Dev. (OIL)

What have we been doing until now in terms of drilled depth ?



Conventional Petroleum Expl. & Dev. (OIL)

Exploration till date primarily in

- **Water depth <100 m and Drilled depth <3500 m**

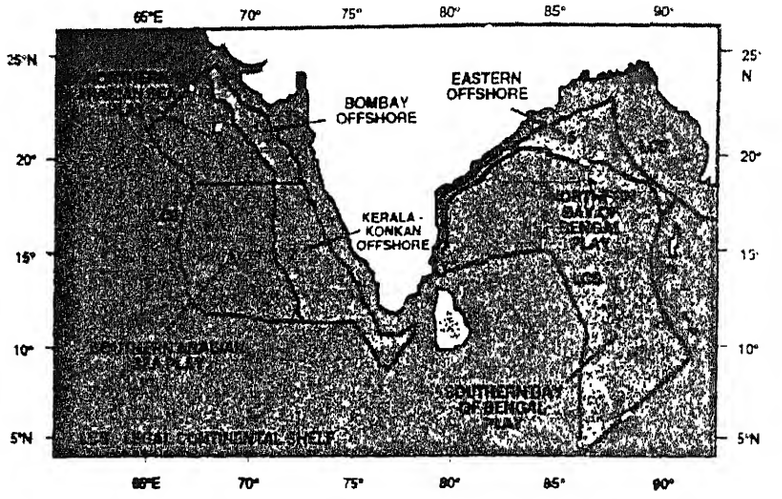
We Should Focus on

- **Water depth >100 m, Drilled depth >3500 m**

Will NELP be an Answer ?

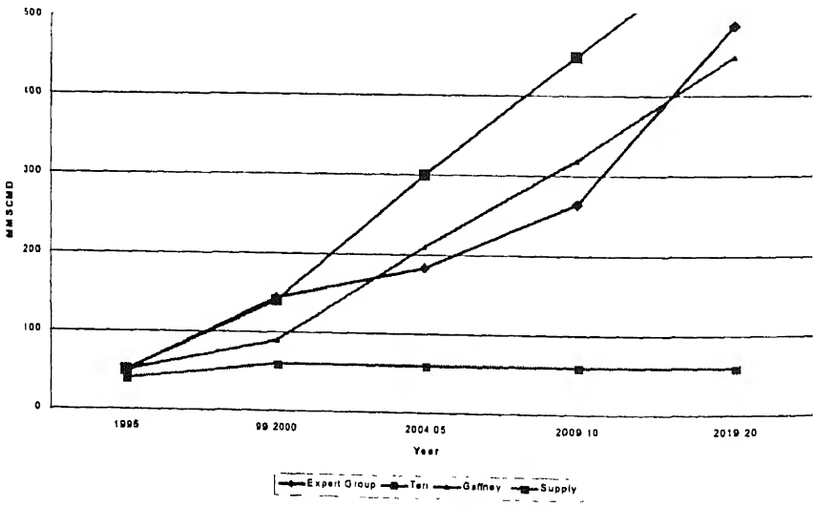
Will NGHP be an Answer ?

Need For More Deep Water Exploration



Conventional Petroleum (Natural Gas)

Demand – Supply Gap In India



Sources Of Gas

Sources of Gas	*Estimated Recoverable Reserves (BCM)*	*R/P Ratio*	*Production Rate (MMSCMD)*	*Land fall point estimate price ($/MMBTU apprx.)*
Natural Gas (Indegenous)	707	21	90	1 7 (ONGC)
Coal Bed Methane	240*	20	33	1 8
Underground Coal Gasification	Very High	N/A	N/A	1 5-2 4
Sub-sea Hydrates	2000**	150	350	2.5-3 5
Total Projected Demand				

* Corresponds to 1060 Bcm of Prognosticated CBM reserves estimated in only 5 coal fields of Bihar and 400 Bcm of CBM in North Gujarat

** Corresponds to 70 000 Tcf (approx 2000 Tcm) of Prognosticated Hydrate Reserves along the Indian Legal Continental shelf

Gas Hydrates : An Economic Long Term Solution

In Place Volumes Of Gas Hydrates

World : 20,000 TCM
India : 2,000 TCM

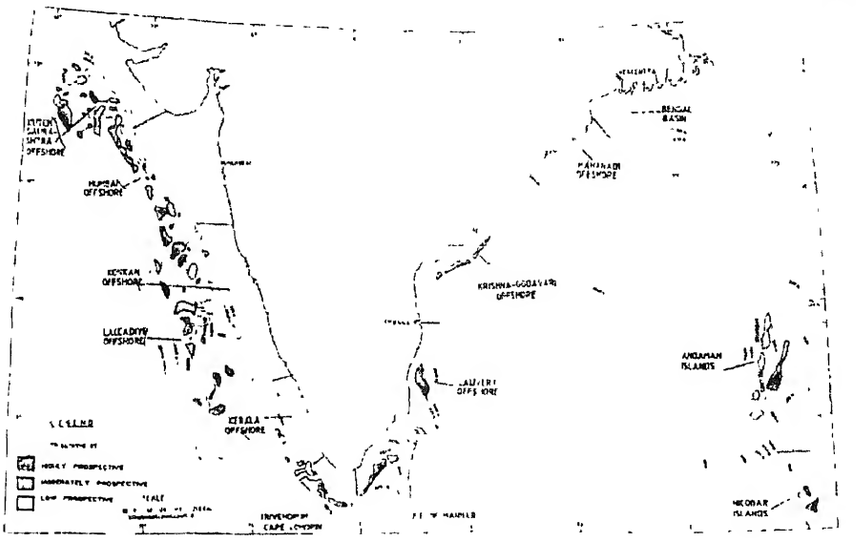
In Comparison to this , conventional gas resources estimates are :

World : 368 TCM
India : 1 TCM

India's Gas potential from Gas Hydrates is 2000 times as compared to its conventional sources.

GAS HYDRATES THUS REPRESENT A VERY LARGE POTENTIAL RESOURCE

Gas Hydrate Potential Areas In Indian Deep Offshore



International Activity in Gas Hydrates (USA)

US Department Of Energy has selected six agencies for Research Projects

- University of California & Scripps Institute of Oceanography
- Joint Oceanographic Institutions
- Chevron Petroleum Technology Company
- Halliburton Energy Services Inc.
- Maurer Technology Inc.
- BP Exploration Inc.

ODP managed by Joint Oceanographic Institutions Inc. under contract from NSF (USA)

ODP leg 164 in Blake Ridge exclusively devoted for hydrate research

International Activity on Gas Hydrate (USA) Contd.

Project Details - Scope of Work

1. University of California & Scripps Institute of Oceanography
   - Characterization of Gas Hydrate Formation
   - Dissociation, Mineralogy & Hydrology of Hydrated sediments
2. Joint Oceanographic Institutions :
   - Develop test tools for hydrate sampling and characterization using JOIDES Resolution
3. Chevron Petroleum Technology Company
   - Gas Hydrate drilling (3 wells in Phase I & II, 7 wells in phase III)
   - Coring and transportation of Hydrate samples

International Activity on Gas Hydrate (USA) Contd.

Project Details - Scope of Work

4. Halliburton Energy Services Inc.
   - Lab experiments / Analytic and Reservoir modeling
   - Assessment of well productivity
   - Development of Hydrate Reservoir simulator
5. Maurer Technology Inc.
   - Technology development to drill, complete and produce Artic methane hydrates
6. BP Exploration Inc.
   - Characterize , Quantify and determine commercial viability of In Situ Gas Hydrates and free gas associated with Hydrates on the Alaskan North Slope

International Activity on Gas Hydrate (Japan)

MITI initiated a 5 year Research Programme

Japanese Participants

- Oil Companies and Energy Utilities
- Research Institutes & Universities

JNOC / JAPEX /GSC participated in drilling a hydrate research well (Mallik 2L-38) in the Mackenzie Delta , Canada

- Well depth was 1150 meters.
- Recovered core of the Methane Hydrate between 886 - 952 meters.

•JNOC / JAPEX consortium drilled the first offshore hydrate well during 1999 in the Nankai Trough area, offshore Japan

JNOC/USGS/USDoE/GSC are undertaking new Research at well Mallik 2002 for studying production potential of Gas Hydrates along with other detailed studies.

International Activity on Gas Hydrate (Canada)

Mallik 2002 Work Programme

- Expected Hydrate Zone Occurrence approx. 900 - 1100 mts.
- Two observable wells with TD 1150 metres and 1200 metres.
- Final production test well with TD 1200 metres

Coring Programme :

- Wireline coring
- Backup conventional coring

Geophysical programme

- Comprehensive suit of downhole logs
- X-hole seismic for hydrate reservoir characterization
- VSP survey

Production Test Programme

- Wireline MDT test
- Thermal simulation tests

The Indian Gas Hydrate Programme

National Gas Hydrate Programme has been launched under the Ministry of Petroleum & Natural Gas

Organisations involved

- ONGC , DGH , GAIL & OIL

DGH estimates Gas Hydrate reserves at 1890 Trillion cubic feet
- This is 3000 times the known reserves

Seismic data has been acquired
- Data interpretation has revealed extensive hydrate presence

Tenth plan proposes that drilling activities be undertaken and the OIDB should continue to provide financial support

Seismic data acquisition of Hydrate blocks is being carried out Under NELP I & NELP II

Forward Path In Gas Hydrates

SHELL'S Paper at the Gas Hydrate Symposium , Japan

There do not appear to be any major technical "Show Stoppers" to Hydrate Associated Gas production if suitable accumulations can be found.

However ;

"Economics of Drilling, Completing, and Producing Deep Water 'Gas Only' wells could be only major issues to be addressed.

Conclusions

There is enough of a Hydrocarbon base in India to attempt self sufficiency

Targets should be :

- Deep Water Oil & Gas Exploration & Dev
- Gas Hydrates

  National Gas Hydrate Programme should be prioritized and Made time bound

- Unconventional Resources
  - InSitu Coal Combustion
  - CBM : Correct step has been taken in awarding blocks

NELP is a step in the right direction

Working Group I

To be held in

Exhibition Hall

TERI, IHC

Working Group I: Oil Security Concerns

Moderator: Mr Nirmal Singh (IAS), Senior Fellow, TERI

Convenor:

Mr S K Sharma, Executive Director (International Trade and Shipping), BPCL

Suggested topics[a]

- Rising oil import dependence, import bill etc.
- Impact of deregulation - Product access; distribution; and availability
- International oil market operations – Role of OPEC and other major producers, choke points on shipping routes, etc.

Members

S No	*Name*	*Designation*	*Organization*
1	Mr A Das	Senior Manager (Utilities), Refinery	Bharat Petroleum Corporation Ltd.
2	Mr R J Donadkar	Senior Manager (Projects), Refinery	Bharat Petroleum Corporation Ltd.
3	Mr R.I A Khan	Senior Distribution Manager, North	Bharat Petroleum Corporation Ltd.
4	Mr S S Ramgarhia	Executive Director (Coordination)	Bharat Petroleum Corporation Ltd.
5	Mr A Saran	Dy. General Manager (Operations)	Bongaigaon Refinery & Petrochemicals Ltd.
6	Mr R M Hazarika	Director General	Bongaigaon Refinery & Petrochemicals Ltd.
7	Mr S K Sharma	Executive Director	BPCL (International Tade and Shipping)
8	Dr Sanjiv Misra	Joint Secretary	Cabinet Secretariat
9	Mr N K Natarajan	DGM	CPCL
10	Mr J M Mehta	Managing Director	Essar Oil Ltd.
11	Mr Raj K Varma	CEO (Marketing)	Essar Oil Ltd.
12	Shri Bharat Balan	Chief Manager (Supply, Operations and Distribution)	HPCL Refinery
13	Shri T Pramanik	Chief Manager (Process Engineering)	HPCL Refinery
14	Shri A K Arora *or* Mr A K Mishra, Executive Director (O)	Director (Refineries)	Indian Oil Corporation Ltd.
15	Shri K K Sharma	Senior Manager (BD)	Indian Oil Corporation Ltd.
16	Shri P S Govindarajan	Executive Director (Planning)	Indian Oil Corporation Ltd.
17	Shri P Sugavanam *or* Shri S K Garg, E D (Finance)	Director (Finance)	Indian Oil Corporation Ltd.
18	Shri S K Sarangi	DGM (CP)	Indian Oil Corporation Ltd.
19	Mr S K Barua	Chief Manager (C&F)	Numaligarh Refinery Limited
20	Dr. Raghavendra D Rao		Reliance Industries, Bombay
21	Mr G B Rao	Executive Vice President	Sun Group
22	Mr K K Kapoor	CEO	Sun Group
23	Shri K V Apte	Chief Manager- LPG Projects	

[a] These topics can be changed (if so desired) by the convenor

S No	Name	Designation	Organization
24	Mr Thomas Zachanah	Dy. General Manager (Corporate Planning)	Kochi Refineries Ltd
25	Mr R Gopinathan	Chief Manager (MIS)	Kochi Refineries Ltd.
26	Shri S S Patel	Chief Manager	GAIL, Noida
27	Shri V.N Dutt	Chief Manager	GAIL, New Delhi
28	Shri Alok Gurtu	Sr. Manager	GAIL, New Delhi
29	Shri A. Kaviraj	Manager	GAIL, New Delhi
30	Shri Handesh Kumar	Manager	GAIL, New Delhi
31	Dr D Ray		ONGC
32	Shri Lambhar Singh		ONGC
33	Shri R Venketarangan		ONGC
34	Shri R K Ghosh		ONGC
35	Shri Vasudeva		ONGC

Working Group II

To be held in

Board Room, 4th Floor

TERI, IHC

Working Group II: Response Strategies to Enhance Oil Security

Moderator: Ms Preety Bhandari, Director, Policy Analysis Division, TERI

Convenor: Mr J S Oberoi, Convenor, Energy Think Tank, Surya Foundation

Suggested topics[a]

- Strategic reserves – Structure; legislation; regulatory provisions; drawdown policy; costs; etc
- Demand restraint – Persuasion; administrative & compulsory measures; allocation & rationing; stockdraw versus demand restraint; etc.
- Fuel switching – Alternative supply sources
- Regional co-operation

Members

S No	*Name*	*Designation*	*Organization*
1	Mr Manu Verma	Commercial Manager	BG India Pvt. Ltd.
2	Mr Pradeep Vijayan	Commercial Manager	BG India Pvt. Ltd.
3	Mr Anil Gupta	DGM (IT)	Bharat Petroleum Corporation Ltd.
4	Mr K A Tnvedi	Manager (Programme & Planning)	Bharat Petroleum Corporation Ltd.
5	Mr Pankaj Srivastava	Joint Director (Deputation to OCC, New Delhi)	Bharat Petroleum Corporation Ltd.
6	Mr D K Phukan	Chief Manager (Technical Services)]	Bongaigaon Refinery & Petrochemicals Ltd.
7	Mr N Rahman	Dy. General Manager (Project)	Bongaigaon Refinery & Petrochemicals Ltd.
8	Mr T V John	Dy. General Manager (F&A)	Bongaigaon Refinery & Petrochemicals Ltd.
9	Mr J S Oberoi, IRTS (Retd)	Convenor	Energy Think Tank
10	Mr H K Kaul	Director (Commercial)	Engineers India Ltd.
11	Mr R Prasad		Engineers India Ltd.
12	Mr Ajit C Kapadia	Managing Director	HoEC
13	Shri M A.Tankiwalla	Chief General Manager	HPCL Refinery
14	Shri S.C.Mehta	Dy. General Manager (Crude & Shipping)	HPCL Refinery
15	Dr A K Bhatnagar *or* Dr S Ghosh, E D (RT), R&D	Director (R&D)	Indian Oil Corporation Ltd.
16	Shri A M Uplenchwar	Director (Pipelines)	Indian Oil Corporation Ltd.
17	Shri Amresh Kapoor	DGM (CC)	Indian Oil Corporation Ltd.
18	Shri U K Basu	DGM (T)	Indian Oil Corporation Ltd.
19	Mr T V Shanbhag	Chief Controller (Chartering and Coordn.Incharge)	Ministry of Shipping

[a] These topics can be changed (if so desired) by the convenor.

S No	Name	Designation	Organization
20	Mr A K Maiti	Senior Manager (Technical Service)	Numaligarh Refinery Limited
21	Mr Reep Hazarika	Senior Manager (Technical Service)	Numaligarh Refinery Limited
22	Shri P K Das	Chief Manager (P&C)	Pipelines HO, Noida
23	Mr A S Soni	Consultant	Sun Group
24	Mr S N Jha	Head Refinery & Pipelines	Sun Group
25	Dr GSK Masud	Senior Vice President	Indian Oiltanking Ltd
26	Mr Kapil Jain	GM(Finance)	Indian Oiltanking Ltd
27	Shri T.K. Majumdar	DGM	GAIL, New Delhi
28	Shri V.S. Sadana	AGM	GAIL, Agra
29	Shri P.K Bhatnagar	Chief Manager	GAIL, New Delhi
30	Shri A.K. Ray	ED	GAIL, New Delhi
31	Shri Rajiv Mathur	DGM	GAIL, New Delhi
32	Shri Ramashish Roy		ONGC
33	Shri S K Batra		ONGC
34	Dr. Anil Jauhari		ONGC
35	Shri E F Osta		ONGC
36	Shri A T Kali		ONGC

BRIEF BIODATA
RAJEEV KHANNA, GENERAL MANAGER, GAIL

Name	:	Rajeev Khanna
Designation	:	General Manager(Business Development), GAIL
Academic/Professional		B.Sc.(H), Petroleum Engineering from Indian Schoolof Mines, Dhanbad, M.B.A., Faculty of Management Studies, Delhi University, Diploma in Petroleum Resources Management, College of Petroleum Studies, Oxford, U.K.

Experience:

A total of 28 years experience in Oil and Gas sector in India comprising of about 13 years in ONGC and OIL - in Oil and Gas Production, Reservoir Engineering, Field Development Planning and Corporate and Strategic Planning. More than 8 years of experience in Planning Commission in two spells , the later being as Joint Advisor(Petroleum, Power and Energy Division).

About 7 years of experience in GAIL in the area of Business Development. The job profile in GAIL involves new business area and Synergetic diversification and GAIL has been successful in broad basing its business portfolio covering exploration and production, gas based power generation, LNG imports, Overseas Projects, Telecom and in addition to above GAIL is actively involved in the development of trans-national gas pipeline projects from east and west.

INTERNATIONAL CONFERENCE ON "OIL & GAS SECURITY"

"GAS SUPPLY DISRUPTIONS - RESPONSE MECHANISM"

RAJEEV KHANNA
GAIL

CONTENTS

- INDIAN GAS SECTOR – AN OVERVIEW
- GAS PROJECTS – SECURITY ASPECTS
- INDIAN GAS MARKET – DEVELOPMENT APPROACH

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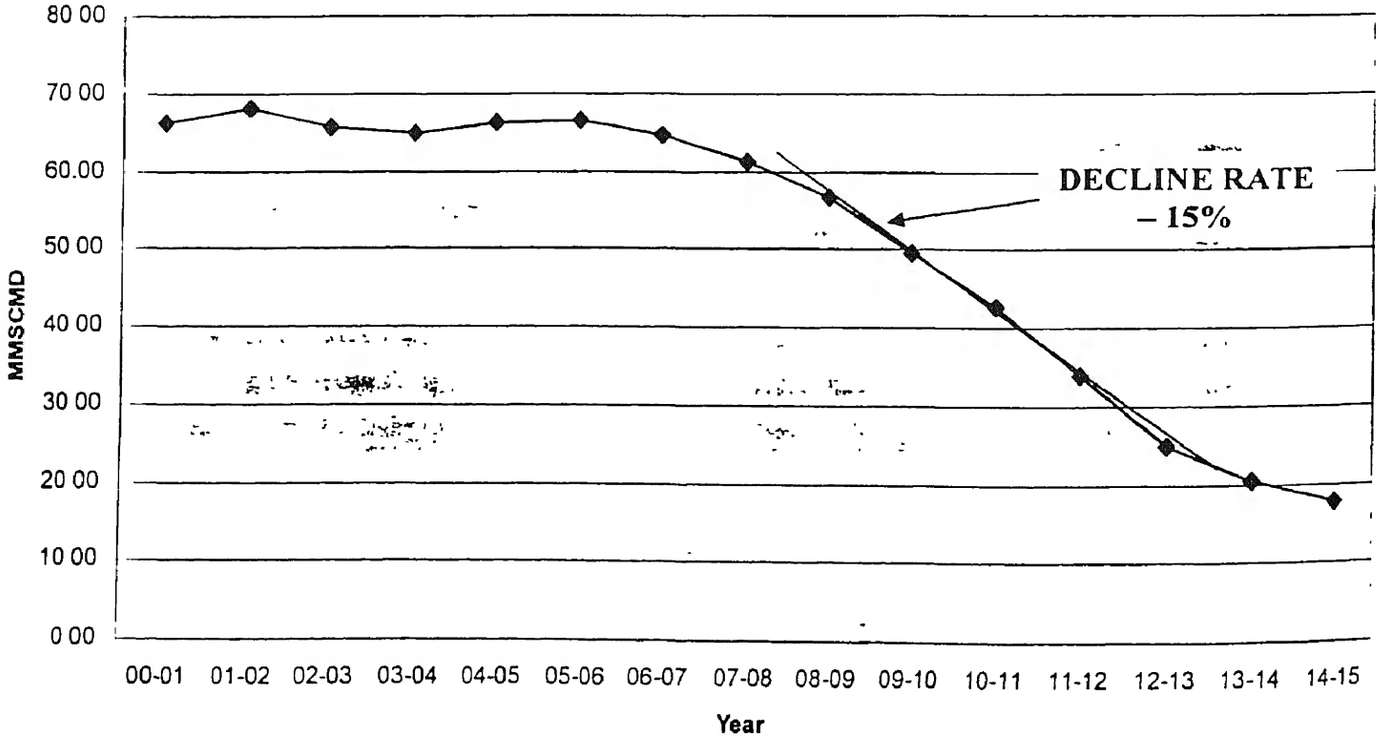
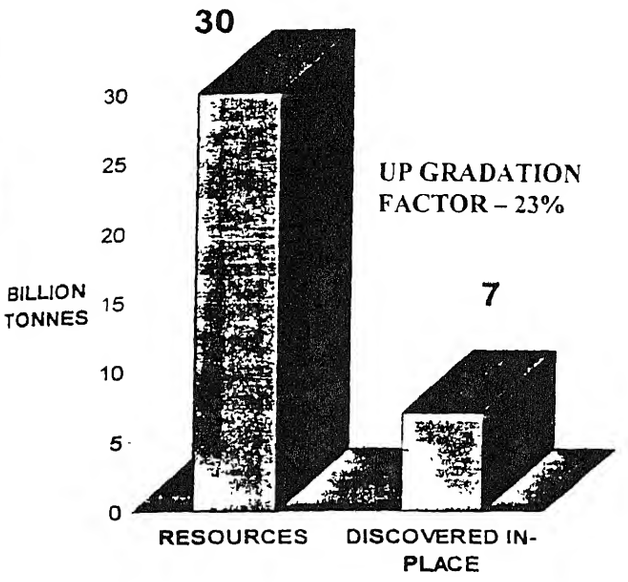
NATURAL GAS SUPPLY – DISCOVERED FIELDS

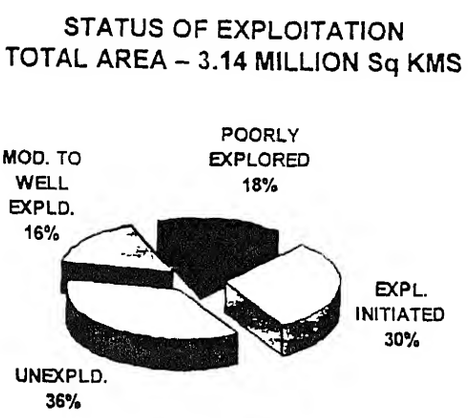


(NOC,s ONLY)

INDIAN HYDROCARBON SECTOR

RESOURCES & EXPLORATION STATUS





LOW INTENSITY OF EXPLOITATION

ADDITIONAL DOMESTIC SUPPLIES – HIGHLY POSSIBLE

NATURAL GAS – DEMAND POTENTIAL

(IN MILLION CUBIC METERS PER DAY)

YEAR	HC VISION 2025	ADB
2001-2002	151	121
2006-2007	231	185
2011-2012	313	260
2024-2025	391	-

GAS DEMAND OUTLOOK – A POSSIBLE SCENARIO

	2006-07	2011-12
✓ DEMAND (MMSCMD)	140	225
✓ DOMESTIC (MMSCMD) SUPPLIES	87	115-125
✓ SHORTFALL (MMSCMD)	53	100-110
✓ SHORTFALL (MMTOE)	17.5	33-41
✓ SHARE OF IMPORTS	38%	45% - 55%
✓ LIKELY VALUE OF GAS IMPORTS	US$ 2 BILLION	US$ 4 BILLION

GAS SUPPLIES – INDIAN MARKET

• DOMESTIC RESERVES • LNG	• NEW DOMESTIC RESERVES (DEEP & ULTRA DEEP WATERS) • COAL BED METHANE • PIPELINE GAS FROM EAST (BANGLADESH, MYANMAR)	• OFFSHORE HYDRATES • PIPELINE GAS FROM WEST (IRAN, ASIAN REPUBLICS)

BETTER OUTLOOK FOR GAS SUPPLY EMERGING FROM EASTERN SIDE

GAS IMPORT – INDIAN MARKETS

GEOGRAPHICAL ADVANTAGE

- PROXIMITY TO MAJOR GLOBAL GAS RESERVES
- RELATIVELY SHORT HAUL LNG SUPPLY SOURCES ON WEST & EAST
- PIPELINE IMPORTS – BEST OPTION (GEO – POLITICS)

CONTENTS

- INDIAN GAS SECTOR – AN OVERVIEW
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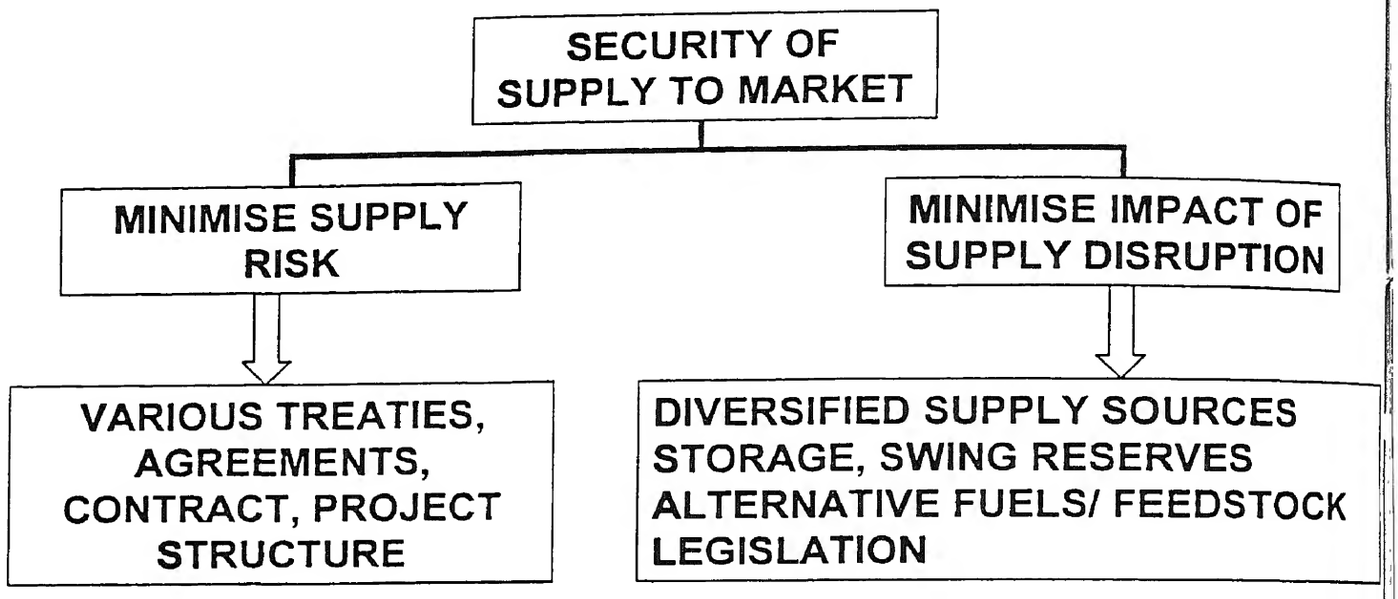
GAS PROJECTS – SECURITY ASPECTS

SECURITY OF SUPPLY – CONTINUOUS SUPPLY OF GAS AT COMPETITIVE PRICE, FOR CONTRACTED VOLUMES & AGREED PERIODS



GAS MARKET – IMPACT OF SUPPLY DISRUPTION

STUDY OF POSSIBLE EVENTS, PROBABILITIES OF OCCURRENCE, DURATION OF DISRUPTION, RESPONSE OPTIONS

- ✓ FREQUENT – MINOR DISRUPTION
- ✓ LESS FREQUENT – MODERATE DISRUPTION
- ✓ INFREQUENT – MAJOR DISRUPTION

CROSS BORDER GAS TRADE – SUPPLY SECURITY

MINIMISE SUPPLY RISK

- ✓ GOVT,S MULTI – LATERAL – AGREEMENT / TREATIES / GUARANTEES
- ✓ CONTRACTUAL PROVISIONS
- ✓ PROJECT STRUCTURE

GOVT,S / MULTI – LATERAL COOPEARTION

- ✓ EUROPEAN ENERGY CHARTER – ENERGY CHARTER TREATY – TRANSIT PROTOCOL
- ✓ ASEAN ENERGY TREATY
- ✓ APEC TREATY

GROWING INTEGRATION & REGIONALISATION OF ENERGY MARKETS

MINIMISE IMPACT OF SUPPLY DISRUPTION

RESPONSE MECHANISM – MAJOR GAS MARKETS

[illegible]	[illegible]
• DIVERSIFIED SUPPLIES • LINE PACK (FEW DAYS) • INTERRUPTIBLE USERS (15 TO 20%) • UNDERGROUND (GAS) / OVER GROUND STORAGES (LNG)	• REGIONAL COOPERATION

MINIMISE IMPACT OF SUPPLY DISRUPTION

RESPONSE MECHANISM – MAJOR GAS MARKETS

• ALTERNATIVES (PROPANE AIR, LPG – AIR, NAPHTHA) • GRID CONNECTIVITY (MAJOR MARKETS – MULTIPLE SUPPLY) • UPWARD FLEXIBILITY IN LNG CONTRACTS (5 TO 10%) • SPOT LNG	• LEGISLATIONS ✓ RATIONING ✓ INTERRUPTIBLE CONTRACTS ✓ DUAL FUEL REQUIREMENTS ✓ MANDATORY STOCKS OF REPLACEMENT FUELS

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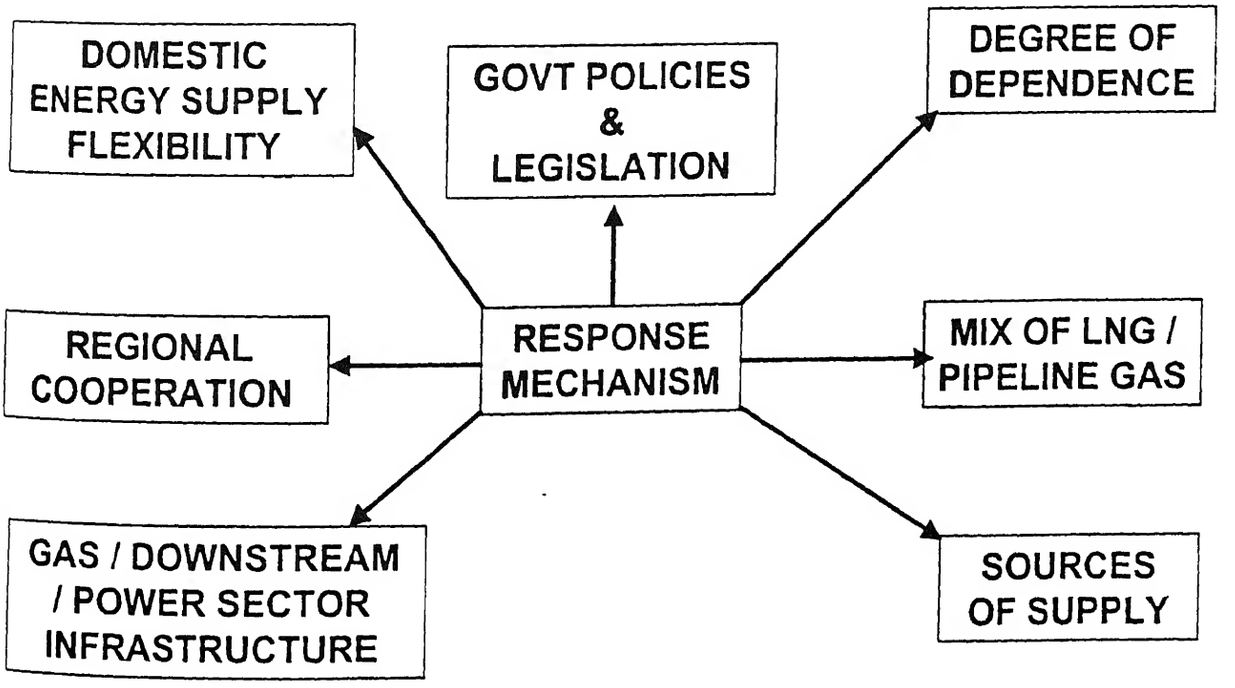
INDIAN GAS MARKET – DEVELOPMENT APPROACH

(SUPPLY - SECURITY – DISRUPTION MANAGEMENT)

- ✓ EMERGING MARKET
- ✓ DOMESTIC RESOURCES UPSIDE
- ✓ END USE PORTFOLIO (POWER SECTOR, RETAIL)
- ✓ PROXIMITY TO MAJOR GLOBAL RESERVES
- ✓ ONGOING PROJECTS / INITIATIVES

INDIAN GAS MARKET

SUPPLY DISRUPTION MANAGEMENT



INDIAN GAS MARKET

RESPONSE MECHANISM

MARKET / OPERATIONAL

- ✓ EFFICIENT NATIONAL POWER & GAS GRID
- ✓ LOCATION OF NEW CAPACITIES (LARGE VOLUME USERS)
- ✓ MARKETS – GRID CONNECTIVITY (SUPPLY FLEXIBILITY – SPARE CAPACITY IN INFRASTRUCTURE)
- ✓ SOURCING STRATEGY GAS PIPELINES AND LNG (MIX OF CONTRACT & SPOT)
- ✓ DOMESTIC GAS SUPPLY (UPWARD FLEXIBILITY PROVISIONS IN PSC,s)

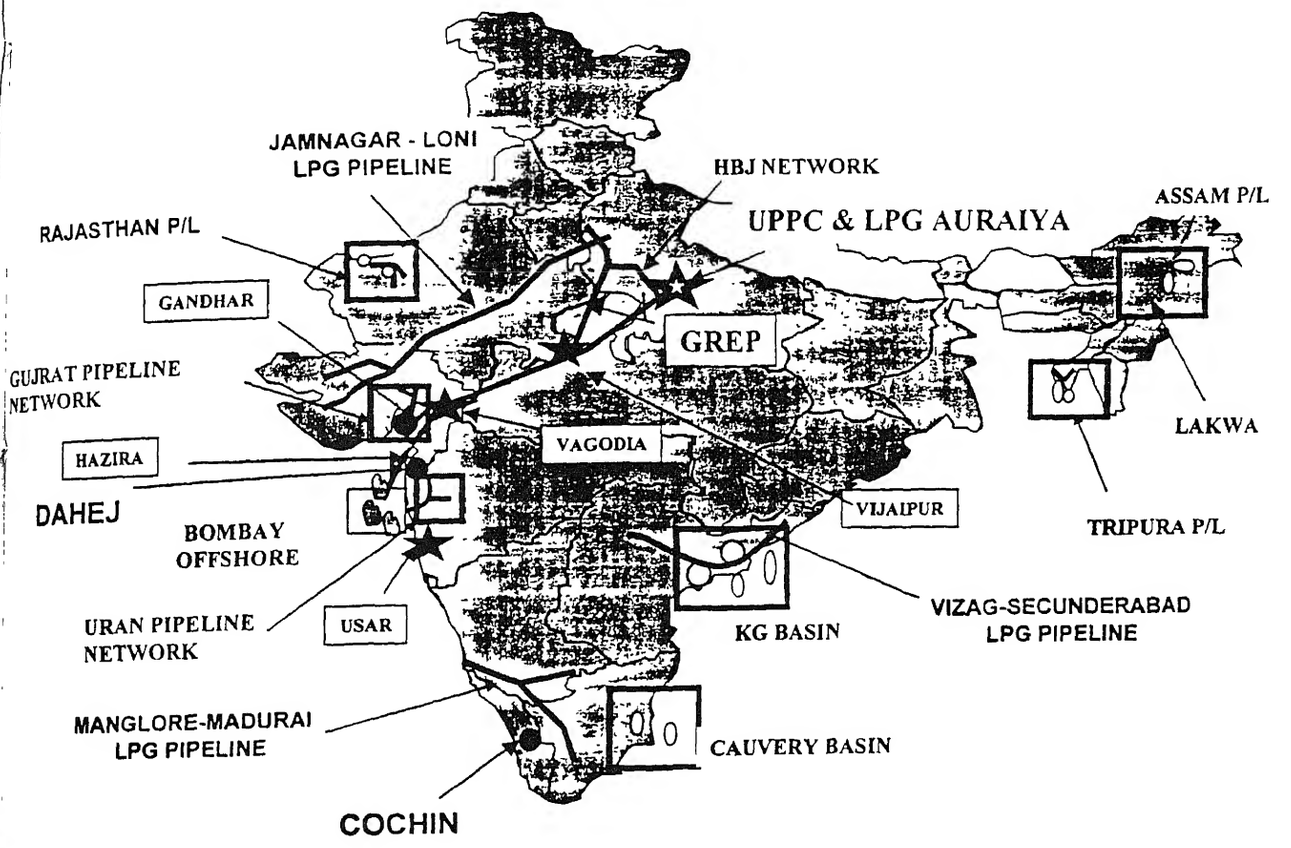
INDIAN GAS MARKET

RESPONSE MECHANISM

MARKET / OPERATIONAL

- ✓ STORAGE (BY COMPANIES OR BY GOVT (PROFIT GAS))
- ✓ ELECTRICITY IMPORTS (REGIONAL HYDEL)
- ✓ OPERATIONAL FLEXIBILITIES (DUAL FUEL CAPACITIES, INTERRUPTIBLE CONTRACTS, HIGHER PLF,s)
- ✓ EQUITY GAS (DIRECT SUPPLIES, PRODUCTS FOR GAS)
- ✓ LNG PROJECTS (MNC's) (LNG SUPPLY FLEXIBILITY, SHIPPING FLEXIBILITY)

GAIL - INFRASTRUCTURE & FACILITIES



THANK YOU

BIODATA

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Date of Birth	17th March 1940
Academic Qualification	Bachelor of Engineering passed with Hons
Other Qualifications /activities	Fellow of Institute of Management Services, London
	Attended various conferences and training Programs in USA, Canada and Japan
	Attended World LPG forum in Tokyo in 1992 and at Vancouver in 1993
	Presented a paper on behalf of the Indian Oil Industry in the LPG forum at Vancouver.
	Member of the Rotary Club of Madras – Chairman of the Community Development
	Safety Committee and also Chairman of the Occupational Information Committee
Marital Status	Married –with two children, a son and a daughter. Both are married and settled abroad
Present assignment	Sr.Vice President (South), Indian Oiltanking
	(a Joint Venture of Indian Oil Corporation

with Oiltanking of Germany)

Earlier Assignments

Handled various assignments as under, in Indian Oil Corporation for 35 years.

Executive Director, Human Resource, 4 yrs in Mumbai
General Manager (LPG), 2 yrs in Delhi

Dy.GM, Management Services for 2 Yrs in Mumbai and in Engineering for 2 yrs in Chennai

Chief/Senior Manager in LPG –6 years in Mumbai

Manager/ Asst manager / Refinery Co-ordinator/ Operations officer

in Chennai, Cochin, Madurai, Bangalore in Marketing, Distribution and Engineering

functions – 14 years

As **Indian Expert** on deputation from Indian Oil Corporation to Brega Oil Co. in Tripoli, Libya for 5 yrs.

Implementing Strategic Storage for Oil

The Necessity

Organisational Aspects

Financial Implications

Delhi, June 1, 2002

Presented by
G.S.K. Masud
Sr Vice President,
Indian Oiltanking a JV of
Indian Oil Corporation and Oiltanking GmbH

Based on the experience of and inputs provided by
Mr.Hellmuth Weisser

- Chairman of Marquard & Bahls AG, active in India through its subsidiary, Oiltanking GmbH
- Vice Chairman of the German parastatal strategic storage organisation EBV
- Member of the advisory sub-committee to the European Union on security of supply

STRUCTURE

- Reason for Strategic Storage
- Characteristics of a successful Strategic Storage System
- Best international accepted practice
- Critical National Security Imperative
- Strategic Storage in the Indian context
- Impact on Public Finances
- Development of Local Oil Infrastructure
- Summary

REASON FOR STRATEGIC STORAGE
Importance

- In today's Hydro Carbon Age the vulnerability of an economy increases with its sophistication and this exponentially so
- The unexpected explosion in oil prices in 1999 brought the subject at hand - the security of our oil supply - back on the international agenda
- Disruptions which affect the availability of oil can have serious repercussions for the economy

REASON FOR STRATEGIC STORAGE
Sources of Disruption

- internal or external
- politically or militarily driven
- an act of terrorism
- an act of god
- or any combination thereof

REASON FOR STRATEGIC STORAGE
Vulnerabilities

Oil dependent economies have become - besides external political problems - increasingly vulnerable to interruptions in oil flows

- due to internal causes
- as well as for two other important external factors

REASON FOR STRATEGIC STORAGE

Vulnerabilities – external factors

- on a world-wide scale inventory levels have been savagely reduced due to
  - just-in-time management and
  - avoidance of high carrying costs
- near capacity limit in crude production (if you forget the temporary slowdown of the world economy)

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REASON FOR STRATEGIC STORAGE

Vulnerabilities

- Today's world-wide oil systems are operated bare bone - there is no slack in the system!
- Thus results in a vulnerability for those countries without adequate strategic reserves to ride out a supply disruption whatever the cause.

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REASON FOR STRATEGIC STORAGE
Vulnerabilities

- The present political instability in the world - especially in Afghanistan & the Middle East - should also refocus the attention to the volatility of today's oil supplies
- The agitation in the Islamic world could easily lead to major policy shifts or civil strife curtailing outflows severely
- If the present conflict turns into a real religious strife, India will see its supplies coming mainly from potentially hostile states

REASON FOR STRATEGIC STORAGE
Vulnerabilities

- The Indian Oil Supply - be it through imports or domestic refineries - is heavily concentrated in Gujarat
- In the context of security of supply, the risk arising from the simmering conflict with Pakistan certainly requires prudent consideration
- The discussion on strategic storage could therefore not have been at a more appropriate time than now

Indian Oiltanking

THE REASON FOR STRATEGIC STORAGE
Aim

- Strategic reserves serve to mitigate fundamental and severe interruptions in the supply of oil
- The presence of security stocks provides the economy and its government crucial additional time to ride out the crisis at hand, and additional time to take counteractive measures
- They also reduce the possibility of being taken politically hostage

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Indian Oiltanking

THE REASON FOR STRATEGIC STORAGE
Who is responsible?

- Due to the fundamental impact energy shortages have on modern economies strategic security concerns must be dealt with by governments and solutions can only lie in the governmental domain

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CHARACTERISTICS OF A SUCCESSFUL STRATEGIC STORAGE SYSTEM

In times of crisis oil must be:

- available,
- available where needed,
- available as needed.

CHARACTERISTICS OF A SUCCESSFUL STRATEGIC STORAGE SYSTEM

In times of crisis the system must:

- have established clear guidelines as to release mechanisms,
- have established who gets what,
- at what prices and conditions,
- and should have been tested.

CHARACTERISTICS OF A SUCCESSFUL STRATEGIC STORAGE SYSTEM

The economic costs:

- Should be optimal (minimal?)
- Should be transparent

BEST INTERNATIONAL ACCEPTED PRACTICE FOR STRATEGIC STORAGE

- Strategic storage lies in the public domain
- Strategic stocks are most effectively and efficiently run by parastatal entities
- Strategic stocks must be held clearly defined in excess of working stocks
- Security stocks should provide maximum flexibility
- Security stock systems and their finances must be transparent

BEST INTERNATIONAL ACCEPTED PRACTICE FOR STRATEGIC STORAGE

This paradigm has recently been confirmed
by the Vice President of the European Union,
Ms Loyola de Palacio,
in her speech to the World Economic Forum
in New York in January this year
endorsing the German system as a model for the EU

BEST INTERNATIONAL ACCEPTED PRACTICE FOR STRATEGIC STORAGE

The German System

- Parastatal system which owns at least 90 % of security stocks in excess of working requirements of market participants
- The system is financed through
  - bank loans to finance 100% of the stocks held and
  - a compulsory levy paid by all importers and refiners at the point of import / refinery gate. This levy covers all running costs like personnel, storage rent and interest for stocks financed
- It is void of any state guarantee - has a AAA rating by Standard & Poors' and thus the cheapest interest rates at its disposal

STRATEGIC STORAGE

Critical National Security Imperative

- Supply of oil has a critical national security imperative for India, especially considering
  - acute volatility in international prices of crude oil and products
  - increasing substantial dependence on crude oil imports
  - developments in Pakistan, Kargil experience, Afghanistan, unstable Middle East
  - implications of cyclone damages in Jamnagar / Kandla and Paradeep keeping in view past experience
  - Total Petroleum Sector Deregulation effective 1st April 2002 - i.e. just-in-time inventory management and no incentives for commercial security stock

STRATEGIC STORAGE

Critical National Security Imperative

- Security of supply system should not only be concentrated on centres of refining, but equally on centres of consumption
- Internal risks of disruption are as pertinent as external risks
  - High concentration of refining centres
  - High dependence on pipeline systems
  - Huge distances which make India vulnerable to
    - military action
    - acts of terrorism
    - natural disasters

STRATEGIC STORAGE IN THE INDIAN CONTEXT

- According to the best international practice, India should adopt a hybrid system of crude and refined product storage for security stocks
- The product stocks should preferably be held in areas of consumption
- To be cost effective best practice has shown that decisions on locations and mode of storage – of course under the overall political guidance – should be on a competitive basis rather than theoretical cost estimates

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STRATEGIC STORAGE IN THE INDIAN CONTEXT

- The combination – for example – of existing infrastructure with new strategic storage may lead - and has led in all countries - to impressive savings in time and money
- Competitive bidding will also serve to create the necessary transparency of a system financed by the public domain and thus the public at large

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IMPACT ON PUBLIC FINANCES

- It goes without saying that the impact on the public finances should be minimal.
- Best practice is to finance the parastatal monetary needs by a combination of bank loans and public levy at the source of import or at the refinery gate.
- How to split between loans and levy?

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IMPACT ON PUBLIC FINANCES
The Split between Loans and Levy

- Adopting international best practice:
  - The oil itself - be it crude or products - can be 100% bank financed
  - In a de-regulated market, provisions for price fluctuations need not to be made
  - The public finances are unaffected apart from a possible sovereign guarantee for the borrowings of the parastatal organisation

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IMPACT ON PUBLIC FINANCES

The Split between Loans and Levy

- Storage can be owned by the parastatal organisation and financed through loans or equity
- However, the German and similar Dutch systems have shown that more cost efficient results can be achieved by renting storage against long or medium term contracts
- Running costs and interest are covered by a levy charged at the point of import or at the refinery gate

IMPACT ON PUBLIC FINANCES

- Following best practice reduces or eliminates budgetary outlay
  - The lending institutions base their credit decisions on the sovereign guarantee, but more importantly on the
  - collection system that guarantees future money streams from imports and refining

DEVELOPMENT OF OIL INFRASTRUCTURE
Alternatives

- As stated earlier, security stocks must be available where needed in times of crisis
- Thus not only does the historically developed infrastructure need expansion, but there is a need to create additional infrastructure at major centres of consumption

DEVELOPMENT OF OIL INFRASTRUCTURE
Alternatives

- Security stock system can give a tremendous impetus to the development of local oil infrastructure by
  - Working closely together with market participants (refiners, pipeline operators, storage companies and marketers)
  - Allowing commingling of fungible products

DEVELOPMENT OF OIL INFRASTRUCTURE
Alternatives

- For example, tankages at the existing and proposed Pipeline Terminals on the major oil pipelines can be increased without very significant additional expenditures
- This could be a very low cost alternative for building up security stock capabilities along the centres of consumption

DEVELOPMENT OF OIL INFRASTRUCTURE
Alternatives

- Professional independent service providers could play a useful role in this context besides avoiding costly asset multiplication through parallel tank installations
- Involving independent professionals could speed up the creation of security storage and funnel additional capital to the oil industry

DEVELOPMENT OF OIL INFRASTRUCTURE
Example

- When Germany was reunited in 1990 the Eastern part of the nation was practically devoid of any useful commercial oil infrastructure
- The combination of commercial need for tankage and the long-term requirements of the security stock organisation led to rapid development of new additional infrastructure leaving the East indistinguishable from the West in just a few years
- Through tendering the long-term storage requirements, the parastatal organisation secured the best available rates and for storage providers the baseload of security stocks made the capital outlay commercially sound and bankable

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DEVELOPMENT OF OIL INFRASTRUCTURE
Cost and Time Aspects

- If we assume that new strategic storage facilities would be set up in consumption centres in conjunction with existing facilities, investment costs for totally new infrastructure could be avoided
- Taking Indian Oiltanking's facilities as an example we could build 100,000 KL each in
  - Goa and
  - Mumbai / Navghar

  With a lead time of approx 8-9 months

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DEVELOPMENT OF OIL INFRASTRUCTURE
Cost and Time Aspects

- These tanks could be offered at a monthly rate of around Rs.90 per kilolitre of tankage

- Applying the German finance model i.e.
  - Finance 100% of the oil through bank loans
  - Finance the storage through long-term contracts and
  - Charge the customer for the net outlay only

The additional cost per litre* would be around 0.2 paise

* (excluding adminstration cost of security stock agency)

SUMMARY

- Strategic storage has become a necessity for modern economies

- It provides the government with considerable time to react to supply crises

- Key pre-requisites to a successful strategic storage system are
  - storage in excess of working stocks
  - availability in times of crisis
  - maximum flexibility in terms of crude and products and
  - regional diversity

SUMMARY

- Strategic storage can be set up without costs to the Government Treasury

- By working with industry and independent storage providers such as Indian Oiltanking, strategic storage can be rapidly created

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Thank You

Presentations of the Working Groups on "Policy framework on Oil & Gas Security in a Deregulated scenario in India"

International Conference on Oil & Gas Security

Summary of Deliberations

Working Group I

Moderator: Mr Nirmal Singh
Convenor: Mr S K Sharma

31st May 2002

Scope and definition of Security Threats

- Rising import dependence
- Market cartelization
- Price volatility
- Exigencies interrupting supplies
- Threat to lifeline infrastructure (HBJ pipeline)

Security Measures

- Short Term Measures
  - Emergency Response Measure
- Medium Term Measure
  - Business Process Measures
- Long Term Measure
  - Developmental Measures

Short Term Measures

Emergency Response Measure

- Maintaining Strategic Reserves within the country is the solution for this type of emergency.
  - Type of reserves
    - Crude stocks
    - 30 days cover (over and above operating stocks)
    - On-site / Off-site
    - Location: EIL study (Rajkot, Uran, Mangalore and Vizag)

...Short-Term Measures...

- Governing body
  - Independent authority to manage strategic reserves
  - Statutory support from an Act of Parliament
  - Drawdown decisions to be decided by the authority
    - Vulnerability to price volatility
    - Vulnerability to supply disruption

...Short -Term Measures

- Financing options
  - Recourse to private investment
  - Cess/levy (legislation necessary)
- Gestation period involved : phased development of strategic reserves

Medium-Term Measures

Business Process Development

- Secure equity crude in overseas oil fields
- Develop off-shore refining capacity
- Build infrastructure in terms of jetties, tankage, and pipelines to sustain emergency distribution at a normal cost

Long-Term Measures

Developmental Measures

- Augmenting indigenous production
- Switch to alternative fuels and non-conventional energy
- Diversification of supply sources
- Conducive investment climate for private capital for E&P activities
- Oil trading and risk management activities
- Energy conservation

Response Mechanisms-WG II

Recommendations

Short-term measures

- Strategic storage of POL
  - Evenly spread out
  - Floating storage
  - Quantity of security cover by Government and companies
- Demand management
- Oil trading

Long term measures

- Equity oil abroad
- Reserve accretion enhancement
  - Deep water
- Enhanced recovery factor-27% to 40%
- Improvement in R/P ratio
- Regional cooperation
  - Trincomalee storage
  - Pipeline linkage with other countries
  - JV refineries

Contd..

- Increase in refining complexity to process variety of crude
- Diversity in supply sources for crude and product
- Infrastructure development for ports
- Oil conservation/demand management
  - mandatory audits
- Improvement in supply infrastructure
- Well developed pipeline grid for products, natural gas and LPG

Contd...

- Greater share for rail transportation
- Alternate energy sources e.g.
  - CBM
  - Gas hydrates
  - Renewables

Policy measures

- Regulatory framework
- Crisis management group
- ABC analysis
- Develop buyers forum

List of participants for the conference on 'Oil & Gas Security' May 31 - June 1, 2002

Sl.No.	Name	Designation	Organization	Add1	Add2	Add3	City&code	Tel.No.	Fax:	Email:
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3	Mr K A Trivedi	Manager (Programme & Planning)	Bharat Petroleum Corporation Ltd	Bharat Bhavan	4&6, Currimbhoy Road	Ballard Estate, P B No 688	Mumbai-400 001	022 2261 8061	022 261 6793	
4	Mr S K Jaidka	Manager, MI & Safety, North	Bharat Petroleum Corporation Ltd	Bharat Bhavan	4&6, Currimbhoy Road	Ballard Estate, P B No 688	Mumbai-400 001	022 2261 8061	022 261 6793	
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6	Mr A Das	Senior Manager (Utilities)	Bharat Petroleum Corporation Ltd	Refinery	Mahul		Mumbai-400 074	022 553 3344	022 554 2970	dasa@bharatpetroleum com
7	Mr S K Sharma	Executive Director, International Trade & Shipping	Bharat Petroleum Corporation Ltd.	Bharat Bhavan	4&6, Currimbhoy Road	Ballard Estate, P B No 688	Mumbai-400 001	022 2261 8061	022 261 6793	
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9	Mr A Saran	Dy General Manager (Operations)	Bongaigaon Refinery & Petrochemicals Ltd	P O Dhaligaon	Dist Bongaigaon		Assam-783 385	03664 20691	03664 41346	brpl@ndb vsnl net in
10	Mr T V John	Dy General Manager (F&A)	Bongaigaon Refinery & Petrochemicals Ltd	Surya Kiran Building	19 Kasturba Gandhi Marg		New Delhi-110 001	3319677/8591, 3716827	3313736	brpl@ndb vsnl net in
11	Mr N Rahman	Dy. General Manager (Project)	Bongaigaon Refinery & Petrochemicals Ltd	P O Dhaligaon	Dist Bongaigaon		Assam-783 385	03664 41359	03664 41363	brplz@gwl vsnl net in
12	Mr D K Phukan	Chief Manager (Technical Services)]	Bongaigaon Refinery & Petrochemicals Ltd	P O Dhaligaon	Dist Bongaigaon		Assam-783 385	03664 20797	03668 41027	brplaz@gw1 dot net in
13	Mr Manu Verma	Commercial Manager	British Gas India Pvt. Ltd.	3rd Floor, Tower-B	First India Place	Sushant Lok-1, Mehrauli-Gurgaon Road	Gurgaon-122 002	91 6356991-95	91 6560241	manu.verma@bg-group com
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19	Mr Suresh Malkani	Senior Manager (Projects), Ports & Terminals Dvn	Engineers India Ltd	Engineers India Bhavan, 4th Floor	1 Bhikaji Cama Place		New Delhi-110 066	610 2121 Extn 3126	618 0315, 616 4873	

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30	Mr Proshanto Banerjee	Chairman & Managing Director	Gas Authority of India Ltd	16, Bhikaji Cama Place	New Delhi		110 066	6102077	610 3055	pbanerjee@gail co in
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33	Mr Tapash Pramanik	Chief Manager (Process Engineering)	Hindustan Petroleum Corporation Ltd	701, Kailash Building	26 Kasturba Gandhi Marg		New Delhi-110 001	331 2996, 373 8719, 332 4675 Extn 304	335 9948	hpclprp@bol net in
34	Mr A N Dixit	Senior Manager - Product Coordinator	Hindustan Petroleum Corporation Ltd	8, S V Marg	Ballard Estate		Mumbai-400 001	022 261 1753, 261 8031 extn 1236	022 261 1822	andixit@hpcl co in
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38	Mr A K Mishra	Executive Director (OPS)	Indian Oil Corporation Ltd	Scope Complex, Core-2	7 Institutional Area	Lodhi Road	New Delhi-110003	436 1053	436 4657, 436 1642	mishraarun@iocl co in
39	Dr A K Bhatnagar	Director (R&D)	Indian Oil Corporation Ltd	Research & Development Centre	Sector-13		Faridabad-121 007, Haryana	528 4420, 4362083 (Delhi)	529 2009, 528 6221	bhatnagarak@iocrnd stpn soft net
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45	Mr P K Das	Chief Manager (P&C)	Indian Oil Corporation, Pipelines HO, Noida							
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49	Dr Mahendra P Lama	Professor	Jawaharlal Nehru University		PW1, Warden	Periyar Hostel	New Delhi - 110 057	610 7676, 616 7557	618 7435, 616 9962	mahendra lama@vsnl com
50	Mr D N Nair	Chief Manager (Corporate Planning)	Kochi Refineries Ltd	Post Bag No 2	Ambalamugal		Ernakulam-682 302	0484 722 061-69, 720 802-04	0484 720 855-6	
51	Mr R Gopinathan	Chief Manager (MIS)	Kochi Refineries Ltd	Post Bag No 2	Ambalamugal		Ernakulam-682 302	0484 780 261-69, 720803, 04	0484 720 855/6	kriadmin@kochirefineries com
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53	Mr S K Barua	Chief Manager (C&F)	Numaligarh Refinery Limited	Tolstoy House, 6th Floor		15-17 Tolstoy Marg	New Delhi-110 001	373 9413, 373 9411	373 9412	numarh@del2 vsnl net in
54	Mr Reep Hazarika	Senior Manager (Technical Service)	Numaligarh Refinery Limited	Numaligarh Refinery Project	Dist. Golaghat		Assam - 785 699	0376 65406, 65407	0376 665405	nrlght@gw1 vsnl.net in
55	Mr A K Maiti	Senior Manager (Technical Service)	Numaligarh Refinery Limited	Tolstoy House	6th Floor	15-17 Tolstoy Marg	New Delhi-110 001	3739411, 3353902	3739412	numarh@del2 vsnl net in
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57	Mr R Venketarangan	General Manager (Geology)	Oil & Natural Gas Corporation	Exploration & Development Directorate	Anveshan Bhavan	Kaulagarh Road	Dehra Dun-248 195	0135 756 205	0135 755 965	anveshan@ddn ongc co in
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59	Mr Sudhir Vasudeva	General Manager (Prodn)	Oil & Natural Gas Corporation	615, Vadushara Bhavan	Bandra (E)		Mumabi-400 051	640 5751, 642 2392	651 6498	suhirvasudeva@hotmail com, su vasudeva@bby ongc co.in
60	Mr Ramashish Roy	General Manager (Prodn)	Oil & Natural Gas Corporation	Vasudhara Bhavan	Bandra (E)		Mumbai-400 051	761 24/83		
61	Mr S K Batra	Dy General Manager (P)	Oil & Natural Gas Corporation	Jeevan Bharati Building	Tower-II, Connaught Circus		New Delhi-110 001	372 5916, 331 0156 ext 1120	372 1761	suresh_batra@hotmail com

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63	Mr Brijendra Singh		Oil & Natural Gas Corporation							
64	Mr Subir Raha	Chairman & Managing Director	Oil & Natural Gas Corporation	9th Floor, Jeevan Bharati Tower-II, Connaught Circus	New Delhi		110 001	3310156, 3323402/332 0973	3313028/331 6413	subir_raha@delhi ongc.co in
65	Mr Brij M Khar	General Manager	Oil & Natural Gas Corporation Ltd	9 Kaulagarh Road			Dehra Dun-248 195	91-135 758630, 757 083-85 ext.5727	91-135-755265	bmkhar@ddn ongc co in
66	Mr Pankaj Srivastava	Joint Director (Operations)	Oil Coordination Committee	Ministry of Petroleum & Natural Gas	2nd Floor, Core-8	Scope Complex, 7 Institutional Area, Lodhi Road	New Delhi-110 003	436 1253, 458 3306 ((noida)		pankaj@occindia org
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68	Mr I L Budhiraja		Reliance Industries Ltd	9th Floor (West Wing)	222 Nairman Point		Mumbai-400 021			
69	Dr Raghavendra D Rao	Energy Economist	Reliance Petroleum Limited	RPL House, 15, Walchand Hirachand Marg	Ballard Estate		Mumbai - 400001	022 268 2269, 261 0442 extn 82269	022 262 6886	raghavendra_d_rao@ril com
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71	Dr G B Rao	Vice President	Sun Group	8th Floor, Meridien Commercial Tower	Raisina Road		New Delhi-110001	332 7200, 332 7300	335 4300	sungroup@vsnl net
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73	Mr K K Kapoor	CEO	Sun Group	Meridien Towers, 9th Floor	10 Windsor Place		New Delhi-110001	335 5411-12	335 5432	sungroup@id eth net
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75	Mr Alexey G Vinogradov	Advisor	The Trade Representation of the Russian Federation in India	Plot No 6 & 7, Block 50-E	Nyaya Marg	Chanakyapuri	New Delhi-110 021	687 3195, 688 9237	687 3189	rusindtrd@ndb vsnl net in
76	Mr T V Shanbhag	Chief Controller (Chartering)	TRANSCHART, Ministry of Shipping	Transport Bhavan, Room No 441	1, Parliament Street		New Delhi-110 001	371 03566	335 2726, 371 8614	ccc@hub nic in
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